United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
United States Department
of Agriculture, Forest
Service, and South
Dakota Agricultural
Experiment Station

Soil Survey of Custer and Pennington Counties, Prairie Parts, South Dakota

How To Use This Soil Survey

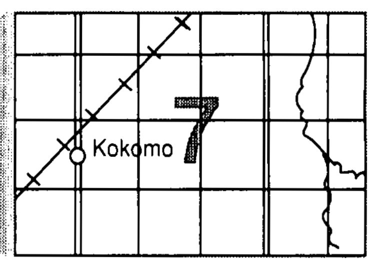
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

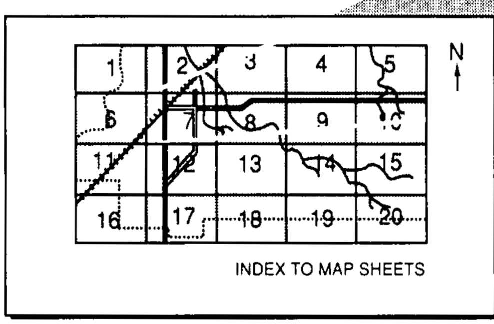
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



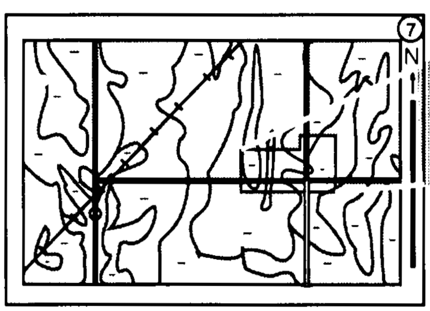
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

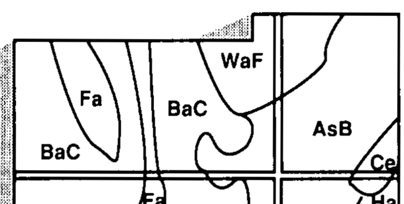


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service, formerly the Soil Conservation Service, has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Natural Resources Conservation Service, the Forest Service, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the East Pennington County Conservation District, Pennington County Conservation District, and Custer County Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue, the Pennington County Commissioners, the Custer County Commissioners, and the National Park Service.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: The Sage Creek Wilderness Area of the Badlands National Park.

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Issued May 1996

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in the survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow over bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Dean F. Fisher
State Conservationist
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Soil Survey of
Custer and Pennington Counties, Prairie Parts, South Dakota

By Robert D. Nielsen, Natural Resources Conservation Service

Soils surveyed by Sharon K. Boschee, Kathleen A. Emerson, Edgar H. Ensz, Arvid C. Meland, Robert D. Nielsen, Janet Oertly, and Kendall K. Olson, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service and Forest Service,
in cooperation with
the South Dakota Agricultural Experiment Station

The survey area is in the southwestern part of South Dakota (fig. 1). It has a total land area of 1,613,267 acres, or about 2,520 square miles. Of this total, about 8,700 acres is water. About 387,492 acres is Federal land. The Forest Service administers the Buffalo Gap National Grasslands, which cover 253,281 acres; the National Park Service administers the Badlands National Park, which covers 112,820 acres; and the Bureau of Land Management administers 32,382 acres. About 1,225,775 acres is privately owned.

According to the 1980 census, Custer, the county seat of Custer County, has a population of 1,830. Rapid City, the county seat of Pennington County, has a population of 46,492. Other cities, towns, and villages in the survey area are Buffalo Gap, Fairburn, and Hermosa in Custer County and New Underwood, Quinn, Rapid City, Wall, and Wasta in Pennington County.

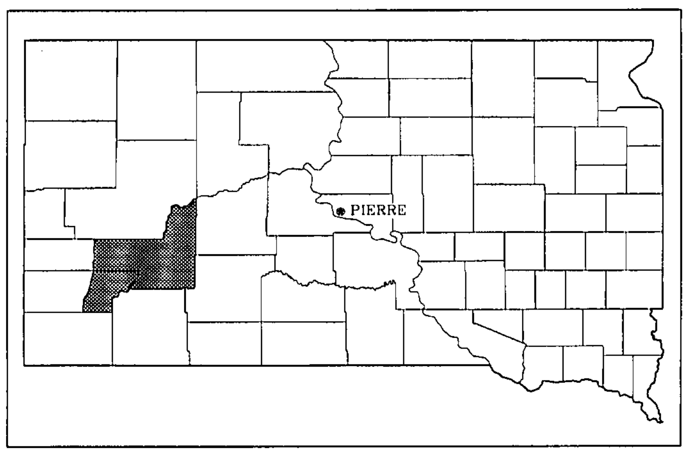

Figure 1.—Location of Custer and Pennington Counties, prairie parts, in South Dakota.

General Nature of the Survey Area

This section gives information concerning the survey area. It describes climate; physiography, relief, and drainage; settlement; ranching and farming; and natural resources.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Wasta, South Dakota, for the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 24 degrees F and the average daily minimum temperature is 11 degrees. The lowest temperature on record, which occurred at Wasta on January 19, 1963, is -33 degrees. In summer, the average temperature is 72 degrees and

the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred at Wasta on July 12, 1954, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 15.53 inches. Of this, 12 inches, or about 75 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 9 inches. The heaviest 1-day rainfall during the period of record was 2.63 inches at Wasta on June 15, 1963. Thunderstorms occur on about 42 days each year.

The average seasonal snowfall is about 32 inches. The greatest snow depth at any one time during the period of record was 28 inches. On the average, 36 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the north-northwest. Average windspeed is highest, 13 miles per hour, in spring.

Physiography, Relief, and Drainage

The survey area is in the Pierre Hills and Tertiary Table Lands divisions of the Great Plains *(8)*. The hilly to gently rolling foothills of the Black Hills comprise the western edge of the survey area and consist of the Carlile, Graneros, and Greenhorn Formations *(7)*. The nearly level to rolling Pierre Hills make up the northern part of the survey area and consist of the Pierre and Fox Hills Formations *(7)*. The nearly level to very steep Tertiary Table Lands make up the southern part of the survey area and consist of the Brule and Chadron Formations. They are characterized by very steep areas of Badland and nearly level to gently sloping alluvial fans. Nearly level loamy terraces are along the major drainageways, the White River, and the Cheyenne River. They are on the higher parts of the landscape and are separated by deeply entrenched drainageways.

The Cheyenne River divides the survey area from south to north and drains about two-thirds of the area. Its tributaries include Battle, Boxelder, French, Lame Johnny, Rapid, and Spring Creeks to the west and Bull, Deep, Indian, Sage, and Spring Draw Creeks to the east. The east-central part of the survey area is drained by the Bad River and Cottonwood Creek. The southeastern corner of the survey area is drained by the White River and its tributaries.

Elevation ranges from about 1,900 feet above sea level where the Cheyenne River flows eastward out of the northeastern part of the survey area to about 3,400 feet in the southwestern part of the survey area.

Settlement

Custer and Pennington Counties were established by the territorial legislature in 1877 *(5, 6)*. Custer County was named in honor of General George A. Custer. It was the hub of early gold mining activities. Rapid City was founded in February 1876. It became the eastern gateway to the Black Hills mining region and an important transportation center.

Rapid City is the principal commercial and population center in the survey area. The smaller communities of Wall, New Underwood, Hermosa, Quinn, and Fairburn were established along the railroad lines in the early 1900's. These communities served the expanding farm and ranch population by exporting agricultural commodities and importing finished goods and services.

The main transportation routes in the survey area are Interstate 90, U.S. Highway 14, and South Dakota Highways 44 and 79. The Chicago and Northwestern Railroad runs east to west, connecting Wall, New Underwood, and Rapid City, and north to south, connecting Rapid City, Hermosa, and Fairburn. Most of the rural roads are not hard surfaced, and many become impassable during inclement weather.

Ranching and Farming

Ranching is the principal enterprise in the survey area, but farming is extensive in the northern part of Pennington County. About 80 percent of the acreage is rangeland, and about 20 percent is used for cultivated crops or for tame pasture and hay *(3)*. The survey area has about 400 ranches and farms, which average about 3,000 acres in size. The trend is toward fewer and larger ranches and farms. Many ranchers in the southern and southwestern parts of the survey area lease additional grazing land from the Buffalo Gap National Grasslands.

Beef cattle and sheep are the primary source of income for many ranchers, and cash crops are a secondary source. Alfalfa, tame grasses, and forage

sorghum provide a source of winter feed for most ranches. Winter wheat, oats, barley, and grain sorghum are the primary cash crops and the main source of income for most farms. Many farmers also manage beef cattle or sheep for a secondary source of income.

The survey area includes portions of the East Pennington, Pennington, and Custer County Conservation Districts *(4)*. The districts were organized in 1946, 1940, and 1940, respectively. They have been instrumental in helping landowners to apply soil conservation practices. These practices include windbreaks, wind stripcropping, contour farming, terraces, grassed waterways, livestock watering facilities, and grass seedings. The assistance provided by the districts has helped to conserve and improve the soil and water resources of the survey area.

Natural Resources

Soil is the most important natural resource in the survey area. It provides a growing medium for crops and for the grasses grazed by livestock. Other natural resources are water, sand and gravel, and wildlife.

The principal sources of water for livestock are stock water impoundments, shallow wells, and deep wells. Generally, the quantity of water in the deep wells is greater but the quality is poor because of a high content of soluble salts. The Cheyenne and White Rivers are sources of water for livestock, wildlife, and irrigation purposes.

Significant deposits of sand and gravel occur along the Cheyenne and White Rivers and on terrace scarps and ridges. These deposits consist mainly of very fine to coarse sand and gravel. Some of the deposits are suitable for mixing concrete and other construction purposes. Most of the deposits, however, contain excessive amounts of shale, mudstone, or chalk fragments and are unsuitable for concrete aggregate or other construction materials. They are suitable as subgrade material for roads or as bituminous aggregate.

Antelope, white-tailed deer, mule deer, sharptail grouse, and turkey are the main wildlife resources in the survey area. Coyote, bobcat, and fox are the main predators. Bass, bluegill, crappies, and perch provide fishing opportunities in many stock water impoundments. Walleye, carp, and catfish inhabit the Cheyenne River. Carp and catfish are the main inhabitants of the White River.

The Badlands National Park is managed as a natural area. It is the best preserved example of the ecosystem of the mixed-grass prairie.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of

horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Some of the boundaries on the soil maps of this survey area do not match those on the soil maps of adjacent counties, and some of the soil names and descriptions do not fully agree. The differences are a result of improvements in the classification of soils, particularly modifications or refinements in soil series concepts. Also, there may be differences in the intensity of mapping or in the extent of the soils within the survey area.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The sixteen associations in the soil survey area have been grouped for broad interpretive purposes. The associations and groups are described on the pages that follow. Because of changes or refinements in some series concepts and differences in the design or extent of the associations, the names of the associations on the general soil map do not coincide exactly with those in the published surveys of adjacent areas. These areas include Meade County to the north, Fall River and Shannon Counties to the south, and Jackson and Haakon Counties to the east.

Soil Descriptions

Nearly Level to Strongly Sloping, Loamy and Silty Soils on Plains and High Terraces

These soils are nearly level to strongly sloping but may be level in some areas. They make up about 21 percent of the survey area. About 75 percent of the acreage is cropland. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Controlling wind erosion and water erosion and conserving moisture are important management concerns.

1. Nunn-Satanta Association

Deep, well drained, nearly level to strongly sloping, loamy soils on high terraces

This association is on high terraces. Slopes generally are smooth and nearly level to strongly sloping. They are steeper on the sides of some drainageways and terrace escarpments. In most areas the drainage pattern is poorly defined.

This association makes up about 19 percent of the survey area. It is about 45 percent Nunn and similar soils, 35 percent Satanta and similar soils, and 20 percent minor soils (fig. 2).

The Nunn soils are on summits and back slopes on high terraces. Slopes range from 0 to 9 percent. Typically, the surface layer is grayish brown loam. The subsoil is brown and grayish brown clay loam. It is calcareous in the lower part. The underlying material is olive, calcareous clay loam.

The Satanta soils are on back slopes on high terraces. Slopes range from 0 to 12 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is grayish brown, yellowish brown, and light yellowish brown clay loam and loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous loam.

Minor in this association are Altvan, Beckton, Haverson, Hoven, Nihill, Samsil, Schamber, and Zigweid soils. Altvan soils are on nearly level terraces adjacent to entrenched drainageways. They are moderately deep to gravelly material. Beckton soils are on foot slopes and in slight depressions. They have a sodium-affected subsoil. Haverson soils are stratified. They are on high flood plains. Hoven soils are in closed depressions. They have a sodium-affected subsoil. The excessively drained Nihill soils are on moderately steep or steep terrace escarpments. They are gravelly throughout. The clayey Pierre soils are on the back slopes of entrenched drainageways that cut back into areas of this association. They have more clay than the major soils and are moderately deep to shale. Samsil soils are shallow to shale bedrock. They are on the

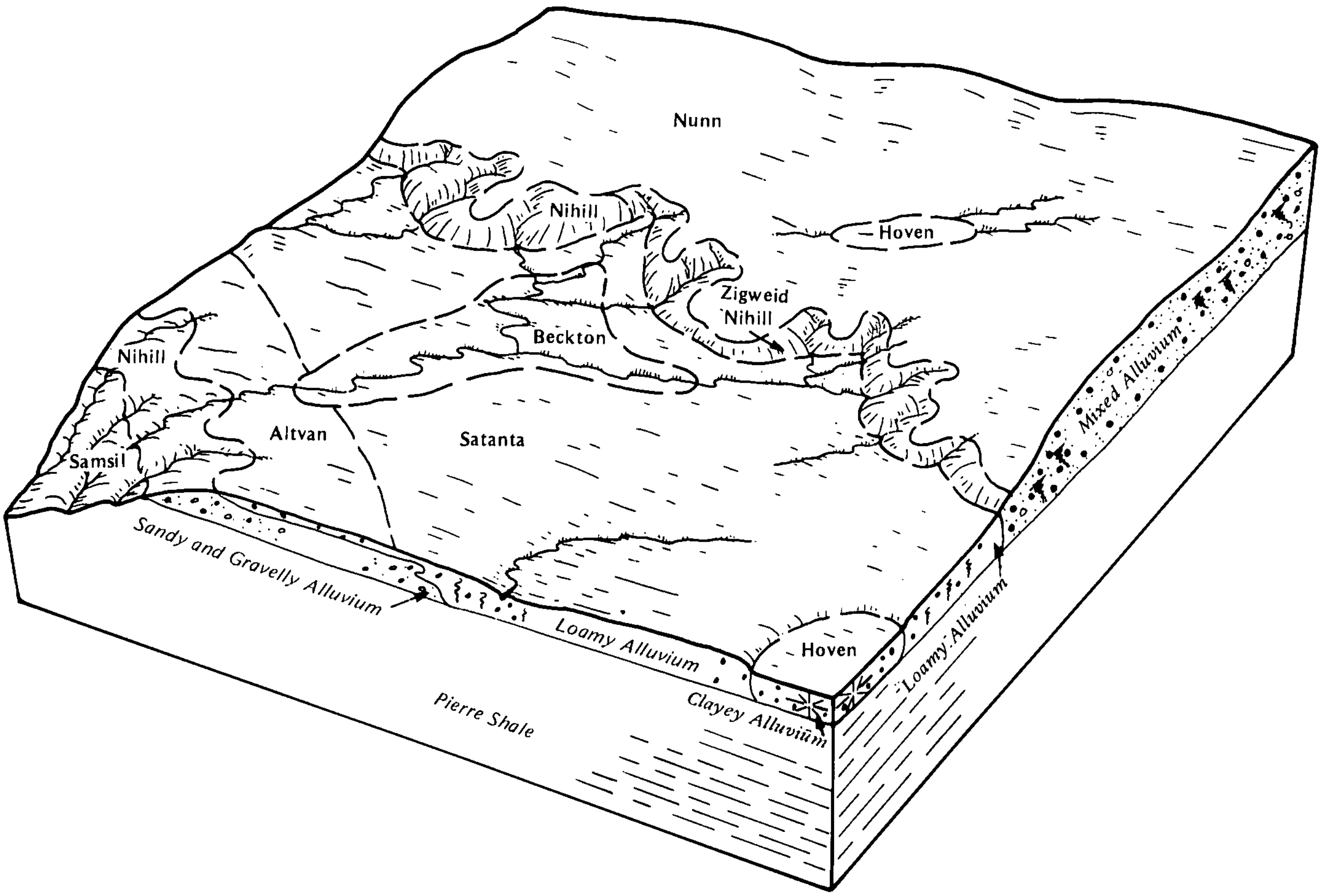

Figure 2.—Pattern of soils, topography, and underlying material in the Nunn-Satanta association.

steep back slopes of entrenched drainageways. Schamber soils are on shoulder slopes on terrace escarpments. They are gravelly throughout. Zigweid soils are on strongly sloping or moderately steep terrace escarpments. They have less clay than the major soils.

About 75 percent of this association is used as cropland. Small grain and alfalfa are the main crops. Conserving moisture and controlling wind erosion and water erosion are important management concerns in cultivated areas. This association is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat.

2. Blackpipe-Wortman Association

Moderately deep, well drained, nearly level to gently sloping, silty soils on plains

This association is on uplands. In most areas the drainage pattern is poorly defined.

This association makes up about 2 percent of the survey area. It is about 50 percent Blackpipe soils, 25 percent Wortman soils, and 25 percent minor soils.

The Blackpipe soils are on gently sloping summits and back slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is dark grayish brown, olive brown, and light olive brown silty clay. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous silty clay loam. Multicolored, soft, interbedded sandstone and shale bedrock is at a depth of about 27 inches.

The Wortman soils are on foot slopes. Slopes range from 0 to 3 percent. Typically, the surface layer is grayish brown silt loam. The subsurface layer is grayish brown silt loam. The subsoil is dark grayish brown and brown silty clay. It is calcareous in the lower part. The underlying material is pale brown, calcareous silty clay loam. The lower part of the subsoil and the underlying material have accumulations of salts. Multicolored, soft,

interbedded sandstone and shale bedrock is at a depth of about 32 inches.

Minor in this association are Cushman, Hoven, Razor, Satanta, and Shingle soils. Cushman soils are on the upper back slopes. They have more sand than the Blackpipe soils and have a lighter colored surface layer. The poorly drained Hoven soils are in closed depressions. Razor soils are on the steeper back slopes along entrenched drainageways. They have a surface layer that is lighter colored than that of the Blackpipe soils. The deep, well drained Satanta soils are on the lower back slopes. They do not have bedrock within a depth of 40 inches. The shallow Shingle soils are on shoulder slopes.

About 70 percent of this association is used as cropland. Some areas are used as rangeland. Small grain and alfalfa are the main crops. Conserving moisture and controlling wind erosion and water erosion are important management concerns in cultivated areas. This association is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat.

Nearly Level and Gently Undulating, Sandy to Clayey Soils on Flood Plains, Terraces, and Fans

These soils are nearly level and gently undulating. They make up about 6 percent of the survey area. About 60 percent of the acreage is cropland. Alfalfa and forage sorghum are the main crops. Controlling wind erosion and water erosion and conserving moisture are important management concerns.

3. Bankard-Haverson-Lohmiller Association

Deep, somewhat excessively drained and well drained, nearly level and gently undulating, sandy, silty, and clayey soils on flood plains

This association is on flood plains along the Cheyenne and White Rivers. Meandering channels and oxbow scars are common in most areas. Surfaces are uneven or hummocky in areas near the river channels. Flooding is usually of short duration and confined to small areas adjacent to the river channels.

This association makes up about 3 percent of the survey area. It is about 35 percent Bankard soils, 25 percent Haverson soils, 25 percent Lohmiller soils, and 15 percent minor soils (fig. 3).

The somewhat excessively drained, sandy Bankard soils are on high flood plains near the river channels. Slopes are hummocky and range from 0 to 4 percent. Typically, the surface layer is light brownish gray loamy fine sand. The underlying material is light brownish gray loamy sand that has thin layers of sandy loam, fine sandy loam, and silt loam in the upper part and multicolored sand in the lower part. The soils are calcareous throughout.

The well drained, silty Haverson soils are on the smooth parts of high flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is grayish brown silt loam. The underlying material is grayish brown, pale brown, and light brownish gray, stratified silty clay loam and sandy loam. The soils are calcareous throughout.

The well drained, clayey Lohmiller soils are on high flood plains adjacent to river breaks. Slopes range from 0 to 3 percent. Typically, the surface layer is light brownish gray silty clay. The underlying material is light brownish gray, stratified silty clay loam and silty clay. The soils are calcareous throughout.

Minor in this association are Glenberg, Kyle, Pierre, and Swanboy soils and Riverwash. The well drained, deep Glenberg soils are on high flood plains. They have more clay than the Bankard soils and more coarse sand than the Haverson and Lohmiller soils. The well drained, deep Kyle soils are on foot slopes on alluvial fans. The moderately deep Pierre soils are on back slopes on plains. They have more clay than the major soils. Pierre soils have shale bedrock within a depth of 40 inches. Swanboy soils are on foot slopes on alluvial fans. They have accumulations of salts within a depth of 10 inches. The Riverwash is along the river channels. It consists of barren, recent alluvial deposits.

About 70 percent of this association is used as rangeland. Some areas are used as cropland. Alfalfa and forage sorghum are the main crops. Controlling the flooding, controlling wind erosion and water erosion, and conserving moisture are important management concerns in cultivated areas. This association is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat.

4. Owanka-Haverson-Colombo Association

Deep, well drained, nearly level, loamy and silty soils on terraces, fans, and flood plains

This association is along streams that flow out of the Black Hills. Slopes are long, smooth, and nearly level.

This association makes up about 3 percent of the survey area. It is about 45 percent Owanka soils, 25 percent Haverson soils, 15 percent Colombo soils, and 15 percent minor soils.

The loamy Owanka soils are on back slopes on terraces and alluvial fans. Slopes range from 0 to 3 percent. Typically, the surface layer is dark grayish brown clay loam. The subsoil is dark grayish brown and

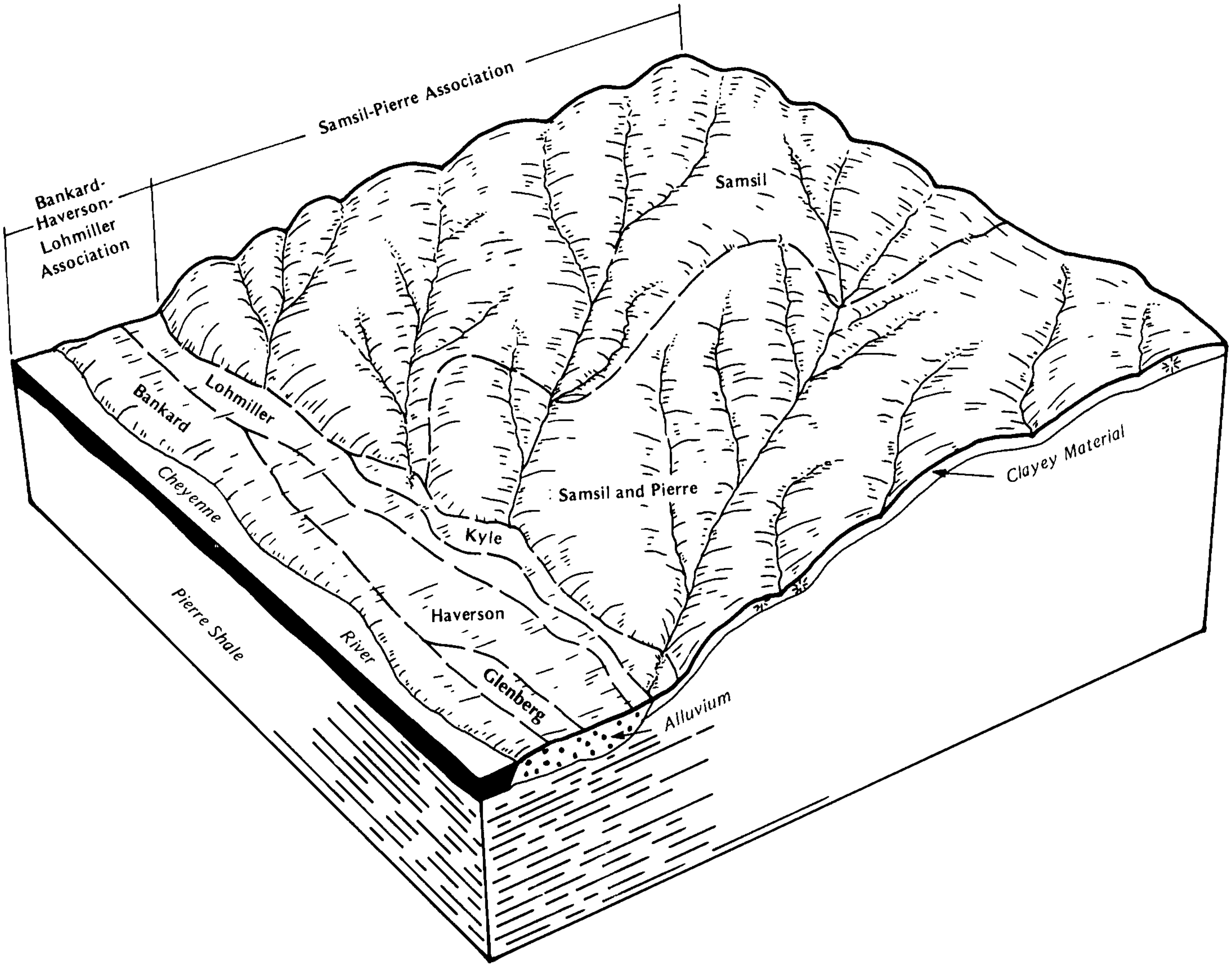

Figure 3.—Pattern of soils and underlying material in the Bankard-Haverson-Lohmiller and the Samsil-Pierre associations.

grayish brown clay loam. It is calcareous in the lower part. The underlying material is grayish brown, calcareous clay loam.

The silty Haverson soils are on high flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is grayish brown silt loam. The underlying material is grayish brown, pale brown, and light brownish gray, stratified silty clay loam and sandy loam. The soils are calcareous throughout.

The loamy Colombo soils are on high flood plains. Slopes range from 0 to 3 percent. Typically, the surface layer is dark grayish brown and brown loam. The underlying material is brown, yellowish brown, and light gray, stratified very fine sandy loam, loam, and sandy clay loam.

Minor in this association are Beckton, Bridgeport, Egas, Lohmiller, and Tilford soils. The sodium-affected Beckton soils are in landscape positions similar to those of the Owanka soils. Bridgeport and Lohmiller soils are in landscape positions similar to those of the Owanka and Haverson soils. Tilford soils are on back slopes on terraces. Bridgeport and Tilford soils have less clay throughout than the Owanka soils. They have a surface layer that is darker than that of the Haverson soils. Lohmiller soils have more clay throughout than the Haverson soils. They have a surface layer that is lighter colored than that of the Owanka soils. The poorly drained Egas soils are on toe slopes. They have accumulations of salts within a depth of 10 inches.

Most of this association is used as cropland. Some

areas are used as rangeland. Alfalfa and forage sorghum are the main crops. Controlling the seasonal flooding and conserving moisture are important management concerns in cultivated areas. This association is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat.

Areas of Nearly Level to Steep, Silty, Loamy, and Clayey Soils and Areas of Badland; on Terraces, Fans, Flood Plains, Dissected Plains, and Other Plains

These soils are nearly level to steep but may be very steep in some areas of Badland. They make up about 18 percent of the survey area. Most of the acreage is rangeland. Maintaining forage production and controlling water erosion and wind erosion are important management concerns.

5. Cedarpass-Denby-Interior Association

Deep, well drained, nearly level to gently sloping, silty, loamy, and clayey soils on terraces, fans, and flood plains

This association is on alluvial fans and terraces along the base of Badlands. Deep, entrenched channels are common in most areas. Slopes are smooth. In most areas the drainage pattern is well defined.

This association makes up about 3 percent of the survey area. It is about 45 percent Cedarpass soils, 30 percent Denby soils, 15 percent Interior soils, and 10 percent minor soils (fig. 4).

The silty Cedarpass soils are on summits on terraces. Slopes range from 0 to 6 percent. Typically, the surface layer is grayish brown silty clay loam. The subsoil is light brownish gray and light gray silty clay loam. The underlying material is white and light brownish gray, stratified silt loam and silty clay loam. The soils are calcareous throughout.

The clayey Denby soils are on the lower parts of summits on terraces. Slopes range from 0 to 3 percent. Typically, the surface layer is light brownish gray silty clay. The subsoil is light brownish gray and light gray clay and clay loam. The underlying material is light gray, stratified silty clay loam. The soils are calcareous throughout.

The loamy Interior soils are on high flood plains and foot slopes on alluvial fans. Slopes range from 0 to 3 percent. Typically, the surface layer is light gray, calcareous loam. The underlying material is white and light gray, stratified, calcareous silt loam and silty clay loam.

Minor in this association are Orella, Wanblee, and Whitewater soils and Badland. Orella soils are on shoulder slopes and the upper back slopes. Whitewater soils are on the slightly higher, nearly level back slopes on dissected plains and other plains. The shallow Orella soils and the moderately deep Whitewater soils have more clay than the major soils. The sodium-affected Wanblee soils are on the lower back slopes that are commonly associated with the Cedarpass soils. The Badland is along the sides of entrenched drainageways. It consists of steep, mudstone outcrops.

Most of this association supports native grasses and is used as rangeland. Some areas are used as cropland. Forage sorghum and alfalfa are the main crops. A high content of sodium in the soils is a limitation. Conserving moisture and controlling wind erosion and water erosion are important management concerns in cultivated areas. This association is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat.

6. Orella-Fairburn-Badland Association

Shallow, well drained, moderately sloping to steep, clayey and loamy soils and Badland on dissected plains

This association is on dissected plains. Slopes generally are convex and are moderately sloping to steep, but they are very steep in some areas of Badland. In most areas the drainage pattern is well defined.

This association makes up 11 percent of the survey area. It is about 40 percent Orella soils, 30 percent Fairburn soils, 15 percent Badland, and 15 percent minor soils (fig. 4).

The clayey Orella soils are on shoulder slopes and the upper back slopes. In this association they generally have slopes of 9 to 25 percent. Typically, the surface layer is light brownish gray, calcareous clay. The underlying material is light gray, calcareous clay. White and pale yellow, calcareous, soft mudstone bedrock is at a depth of about 14 inches.

The loamy Fairburn soils are on back slopes. Slopes range from 9 to 45 percent. Typically, the surface layer is brown, calcareous clay loam. The underlying material is grayish brown and light brownish gray, calcareous clay loam. Light gray, soft, calcareous, interbedded, very fine grained sandstone and mudstone bedrock is at a depth of about 15 inches.

The Badland is barren mudstone. It does not support grazable vegetation.

Minor in this association are Cedarpass, Denby, Hisle, Interior, and Pierre soils. These soils are more

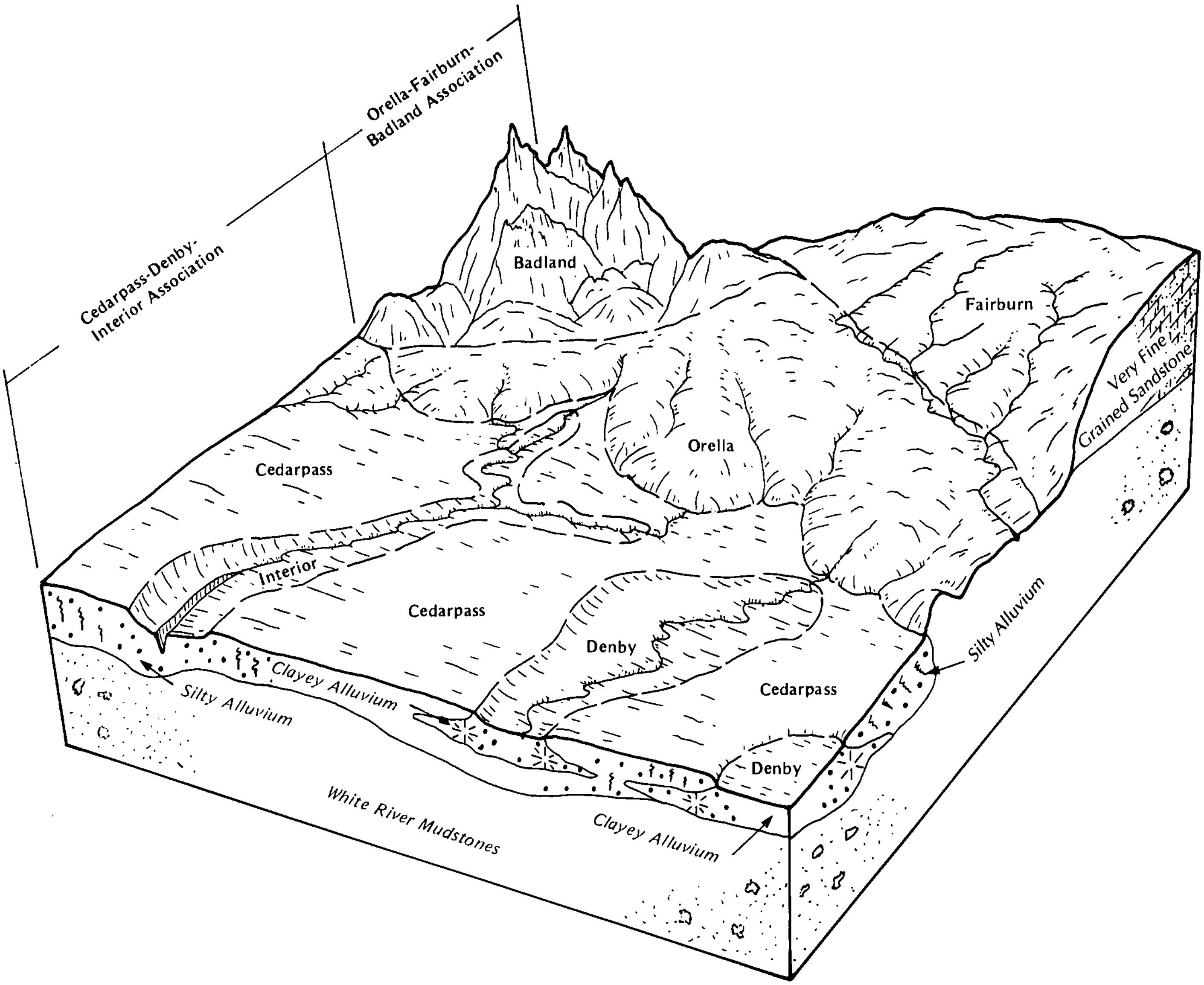

Figure 4.—Pattern of soils, topography, and underlying material in the Cedarpass-Denby-Interior and the Orella-Fairburn-Badland associations.

than 20 inches deep over bedrock. Cedarpass and Denby soils are on terraces. The sodium-affected Hisle soils are on the lower back slopes and foot slopes. The deep, well drained Interior soils are on high flood plains. Pierre soils are on the lower back slopes.

All of this association supports native grasses and is used as rangeland. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It is not suited to cultivated crops or to tame pasture and hay.

7. Orella-Hisle-Whitewater Association

Shallow and moderately deep, well drained, nearly level to strongly sloping, clayey and silty soils on dissected plains and other plains

This association is on dissected plains and other plains. Slopes generally are convex and are nearly level to strongly sloping, but they are moderately steep or steep in some areas. In most areas the drainage pattern is well defined, but it is poorly defined in some areas of the Hisle soils.

This association makes up 4 percent of the survey area. It is about 35 percent Orella soils, 30 percent Hisle soils, 20 percent Whitewater soils, and 15 percent minor soils.

The shallow, clayey Orella soils are on shoulder slopes and the upper back slopes. In this association they generally have slopes of 6 to 15 percent. Typically, the surface layer is light brownish gray, calcareous clay. The underlying material is light gray, calcareous clay. White and pale yellow, calcareous, soft mudstone bedrock is at a depth of about 14 inches.

The moderately deep, silty, sodium-affected Hisle soils are on the gently sloping to nearly level, lower back slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is grayish brown silt loam. The subsoil is brown and pale brown, calcareous silty clay. It has accumulations of salts and carbonate in the lower part. The underlying material is pale brown, calcareous silty clay. Light gray, calcareous, soft shale bedrock is at a depth of about 28 inches.

The moderately deep, clayey Whitewater soils are on gently sloping to nearly level back slopes and summits. Slopes range from 0 to 6 percent. Typically, the surface layer is gray clay. The subsoil also is gray clay. The underlying material is light gray clay. Pinkish gray, soft mudstone bedrock is at a depth of about 33 inches. The soils are calcareous throughout.

Minor in this association are Cedarpass, Denby, Fairburn, Interior, and Wanblee soils and Badland. Cedarpass and Denby soils are on summits on terraces. Interior soils are on high flood plains. They do not have bedrock within a depth of 40 inches. Fairburn soils are in landscape positions similar to those of the Orella soils. They have less clay than the Orella soils. The sodium-affected Wanblee soils are in landscape positions similar to those of the Hisle soils. They have less clay than the Hisle soils. The Badland is on the sides of some ridges and escarpments. It consists of mudstone outcrops.

All of this association supports native grasses and is used as rangeland. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It is not suited to cultivated crops or to tame pasture and hay.

Nearly Level to Steep, Loamy and Silty Soils on Dissected Plains and Other Plains

These soils make up about 15 percent of the survey area. About 85 percent of the acreage is rangeland. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Maintaining forage production, controlling erosion, and conserving moisture are important management concerns.

8. Norrest-Fairburn-Emigrant Association

Moderately deep and shallow, well drained, nearly level to steep, silty and loamy soils on dissected plains and other plains

This association is on dissected plains and other plains. Slopes generally are convex and are gently sloping to steep, but they are nearly level in some areas. In most areas the drainage pattern is well defined.

This association makes up about 9 percent of the survey area. It is about 40 percent Norrest soils, 25 percent Fairburn soils, 15 percent Emigrant soils, and 20 percent minor soils.

The silty, moderately deep Norrest soils are on moderately sloping and strongly sloping back slopes. In this association they generally have slopes of 6 to 15 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is light brownish gray silty clay. The underlying material is white clay loam. Very pale brown, soft, calcareous mudstone bedrock is at a depth of about 29 inches. The soils are calcareous throughout.

The loamy, shallow Fairburn soils are on back slopes. Slopes range from 15 to 40 percent. Typically, the surface layer is brown, calcareous clay loam. The underlying material is grayish brown and light brownish gray, calcareous clay loam. Light gray, soft, calcareous, very fine grained sandstone and shale bedrock is at a depth of about 15 inches.

The loamy, moderately deep Emigrant soils are on nearly level to gently sloping back slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous clay loam. Brown, soft, calcareous mudstone and sandstone bedrock is at a depth of about 33 inches.

Minor in this association are Baca, Lohmiller, Manvel, Orella, and Wortman soils and Badland. Baca soils are on foot slopes and alluvial fans. The stratified Lohmiller soils are on narrow high flood plains. Manvel soils are on foot slopes on plains. Baca, Lohmiller, and Manvel soils do not have mudstone or shale bedrock within a depth of 60 inches. The clayey Orella soils are in landscape positions similar to those of the Fairburn soils. The sodium-affected Wortman soils are on foot slopes. The Badland is on the sides of some ridges and escarpments. It consists of mudstone outcrops.

Most of this association supports native grasses and is used as rangeland. Areas of the Emigrant soils are used as cropland. Small grain and alfalfa are the main crops. Maintaining forage production and controlling

erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It is generally not suited to cultivated crops or to tame pasture and hay.

9. Blackpipe-Norrest-Wortman Association

Moderately deep, well drained, nearly level to rolling, loamy and silty soils on dissected plains and other plains

This association is on dissected plains and other plains. Slopes are nearly level to gently rolling in most areas but are rolling along the sides of some drainageways. The drainage pattern is well defined.

This association makes up 6 percent of the survey area. It is about 35 percent Blackpipe soils, 30 percent Norrest soils, 20 percent Wortman soils, and 15 percent minor soils.

The loamy Blackpipe soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown clay loam. The subsoil is grayish brown and light brownish gray clay and clay loam. It is calcareous in the lower part. White, calcareous, soft mudstone bedrock is at a depth of about 29 inches.

The silty Norrest soils are on back slopes. Slopes range from 6 to 15 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is light brownish gray silty clay. The underlying material is white clay loam. Very pale brown, soft, calcareous mudstone bedrock is at a depth of about 29 inches. The soils are calcareous throughout.

The silty Wortman soils are on nearly level and very gently sloping foot slopes. Slopes range from 0 to 4 percent. Typically, the surface layer is grayish brown silt loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray silty clay. It is calcareous in the lower part. Light gray, soft, calcareous mudstone bedrock is at a depth of about 34 inches.

Minor in this association are Cactusflat, Fairburn, Kyle, Orella, and Wanblee soils and Badland. The deep Cactusflat and Kyle soils are on foot slopes on alluvial fans. The shallow Fairburn and Orella soils are on shoulder slopes and the upper back slopes. Wanblee soils are in landscape positions similar to those of the Wortman soils. They have a surface layer that is thinner and lighter colored than that of the Wortman soils. The Badland is along the steeper back slopes of some drainageways. It consists of mudstone outcrops.

About 75 percent of this association supports native grasses and is used as rangeland. Some areas are used as cropland. Alfalfa and small grain are the main crops. They are grown mainly in areas of the Blackpipe soils, in the less sloping areas of the Norrest soils, and in some areas of the minor soils. Conserving moisture and controlling erosion are important management concerns in cultivated areas. In the less sloping areas, this association is suited to cultivated crops and to tame pasture and hay. All of this association is suited to rangeland and to rangeland wildlife habitat.

Nearly Level to Very Steep, Clayey and Silty Soils on Dissected Plains, Other Plains, and Fans

These soils make up about 34 percent of the survey area. About 80 percent of the acreage is rangeland. Maintaining forage production and controlling erosion are important management concerns.

10. Pierre-Kyle Association

Moderately deep and deep, well drained, nearly level to strongly sloping, clayey soils on dissected plains, other plains, and fans

This association is on uplands. Slopes generally are gently sloping to strongly sloping but are nearly level in some areas. They are steeper along some drainageways. The drainage pattern is well defined.

This association makes up about 10 percent of the survey area. It is about 45 percent Pierre soils, 40 percent Kyle soils, and 15 percent minor soils.

The moderately deep Pierre soils are on back slopes. In this association they generally have slopes of 2 to 15 percent. Typically, the surface layer is dark grayish brown clay. The subsoil is grayish brown and olive gray, calcareous clay. It contains few fragments of shale in the lower part. The underlying material is light gray, calcareous clay. It contains many fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches.

The deep Kyle soils are on foot slopes on alluvial fans. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown clay. The subsoil is grayish brown, calcareous clay. The underlying material is light brownish gray, calcareous clay.

Minor in this association are Hisle, Lohmiller, Nihill, Nunn, and Samsil soils. The sodium-affected Hisle soils are on the lower back slopes on plains. The stratified Lohmiller soils are on narrow high flood plains. The excessively drained Nihill soils and the loamy Nunn soils are on back slopes on high terraces. Nihill soils have gravelly material within a depth of 10 inches. The shallow Samsil soils are on shoulder slopes and along some of the steeper back slopes. They have shale bedrock within a depth of 10 to 20 inches.

About 75 percent of this association supports native grasses and is used as rangeland. Some areas are used as cropland. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. Small grain and alfalfa are the main

crops. They are grown mainly in the less sloping areas of the Kyle and Pierre soils. Conserving moisture and controlling erosion are important concerns in cultivated areas. In the less sloping areas, this association is suited to cultivated crops and to tame pasture and hay. All of this association is suited to rangeland and to rangeland wildlife habitat.

11. Samsil-Pierre Association

Shallow and moderately deep, well drained, moderately sloping to very steep, clayey soils on dissected plains

This association is on ridges and breaks along the Cheyenne River and its major tributaries. The landscape is characterized by steep slopes and deeply entrenched drainageways. Slopes are moderately steep to very steep along the drainageways and moderately sloping to moderately steep on the foot slopes and drainage divides. The drainage pattern is well defined, and gullies are common.

This association makes up about 19 percent of the survey area. It is about 60 percent Samsil soils, 30 percent Pierre soils, and 10 percent minor soils (fig. 3).

The shallow Samsil soils are on shoulder slopes and the upper back slopes. In this association they generally have slopes of 15 to 60 percent. Typically, the surface layer is light brownish gray, calcareous clay. The underlying material is light brownish gray and light olive gray, calcareous clay. It contains many fragments of shale. Light gray, soft shale bedrock is at a depth of about 17 inches.

The moderately deep Pierre soils are on back slopes. In this association they generally have slopes of 6 to 25 percent. Typically, the surface layer is dark grayish brown clay. The subsoil is grayish brown and olive gray, calcareous clay. It contains few fragments of shale in the lower part. The underlying material is light gray, calcareous clay. It contains many fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches.

Minor in this association are Hisle, Kyle, Lohmiller, and Schamber soils. The sodium-affected Hisle soils are on the lower back slopes on plains. The deep Kyle soils are on foot slopes on alluvial fans. The deep, stratified Lohmiller soils are on high flood plains. The deep, excessively drained Schamber soils are on shoulder slopes. They are gravelly sand throughout.

All of this association supports native grasses and is used as rangeland. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It is not suited to cultivated crops or to tame pasture and hay.

12. Midway-Razor Association

Shallow and moderately deep, well drained, moderately sloping to steep, silty and clayey soils on dissected plains

This association is on dissected plains. Slopes generally are moderately sloping to steep in most areas, but they are gently sloping in places. The drainage pattern is well defined, and gullies are common.

This association makes up about 2 percent of the survey area. It is about 45 percent Midway soils, 40 percent Razor soils, and 15 percent minor soils (fig. 5).

The shallow, silty Midway soils are on shoulder slopes and the upper back slopes. Slopes range from 9 to 40 percent. Typically, the surface layer is yellowish brown silty clay loam. The underlying material is light brownish gray clay loam. Light brownish gray and brownish yellow, soft, interbedded shale and sandstone bedrock is at a depth of about 16 inches. The soils are calcareous throughout.

The moderately deep, clayey Razor soils are on the lower back slopes. Slopes range from 6 to 15 percent. Typically, the surface layer is grayish brown silty clay. The subsoil is light yellowish brown and pale olive silty clay. The underlying material is pale olive clay loam. Light gray, soft shale bedrock is at a depth of about 30 inches. The soils are calcareous throughout.

Minor in this association are Blackpipe, Egas, Hisle, Ottumwa, Pierre, Savo, and Shingle soils and Rock outcrop. The moderately deep Blackpipe soils are on nearly level to gently sloping summits and back slopes. They have more clay in the subsoil than the major soils. The deep, poorly drained Egas soils are on toe slopes. The sodium-affected Hisle soils are on the lower back slopes. The deep Ottumwa and Savo soils are on nearly level to gently sloping foot slopes. The moderately deep Pierre soils are in landscape positions similar to those of the Razor soils. They have more clay throughout than the Razor soils. The shallow Shingle soils are in landscape positions similar to those of the Midway soils. They have less clay than the Midway soils. The Rock outcrop is along some of the steep ridges and sides of deeply entrenched drainageways. It consists of exposures of soft shale and sandstone.

All of this association supports native grasses and is used as rangeland. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It is not suited to cultivated crops or to tame pasture and hay.

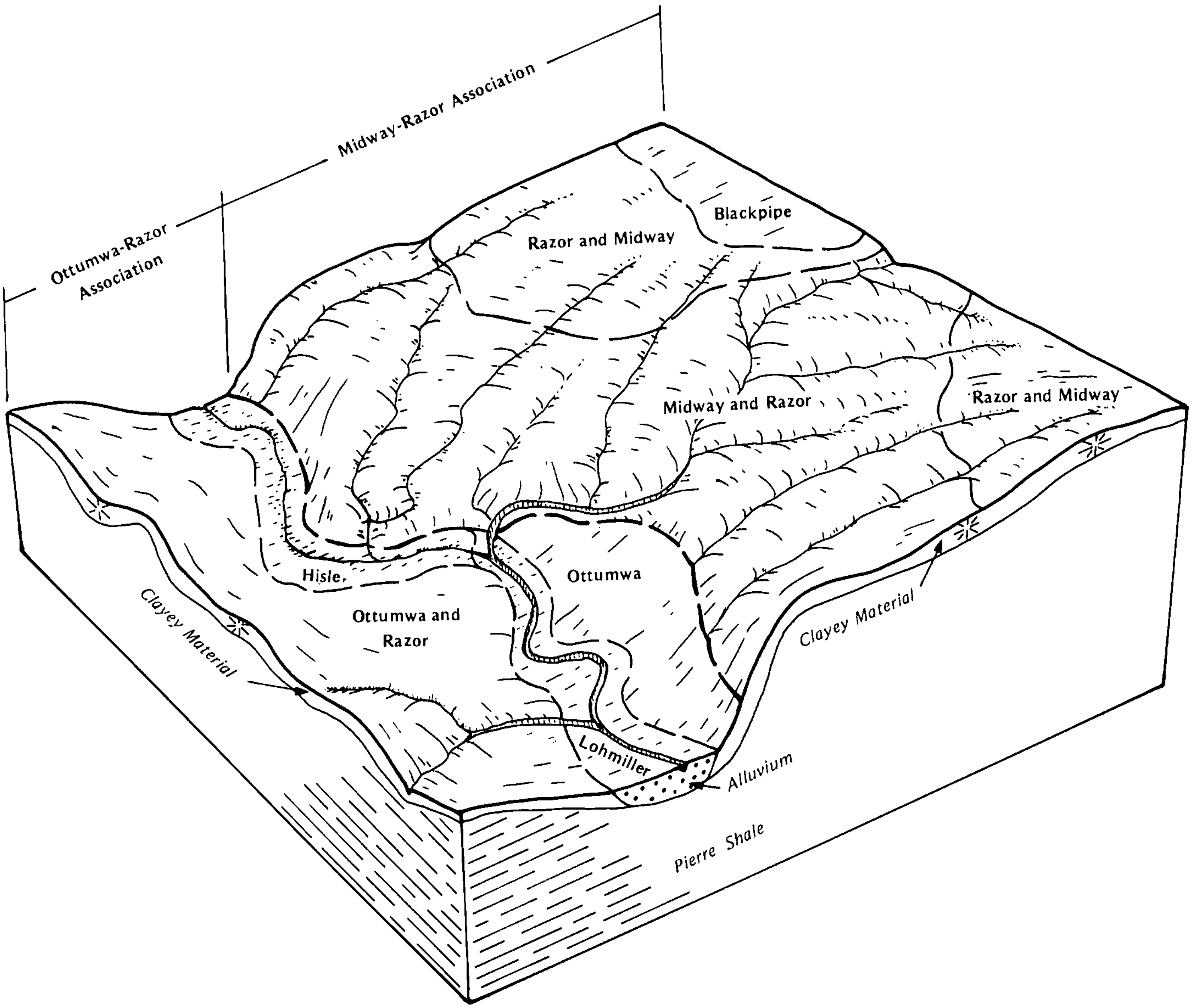

Figure 5.—Pattern of soils and underlying material in the Ottumwa-Razor and the Midway-Razor associations.

13. Ottumwa-Razor Association

Deep and moderately deep, well drained, nearly level to strongly sloping, clayey soils on dissected plains and other plains

This association is on foot slopes and back slopes on dissected plains and other plains. Slopes generally are nearly level to moderately sloping but are strongly sloping along some drainageways. The drainage pattern is well defined.

This association makes up about 3 percent of the survey area. It is about 60 percent Ottumwa soils, 30 percent Razor soils, and 10 percent minor soils (fig. 5).

The deep Ottumwa soils are on the lower back slopes and on foot slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is olive gray clay. The subsoil is olive gray and olive clay. It is calcareous in the lower part. The underlying material is olive gray clay. Light gray, soft shale bedrock is at a depth of about 51 inches.

The moderately deep Razor soils are on back slopes. Slopes range from 2 to 15 percent. Typically, the surface layer is grayish brown silty clay. The subsoil is light yellowish brown and pale olive silty clay. The underlying material is pale olive clay loam. Light gray, soft shale bedrock is at a depth of about 30 inches.

The soils are calcareous throughout.

Minor in this association are Egas, Hisle, Lohmiller, and Midway soils. The poorly drained Egas soils are on toe slopes. The sodium-affected Hisle soils are on the lower back slopes. The stratified Lohmiller soils are on high flood plains. The shallow Midway soils are on shoulder slopes and the upper back slopes.

Most of this association is used as cropland. Small grain and alfalfa are the main crops. Conserving moisture and controlling erosion are important management concerns in cultivated areas. This association is suited to cultivated crops, tame pasture and hay, rangeland, and rangeland wildlife habitat.

Nearly Level to Very Steep, Silty and Loamy Soils on Dissected Plains and Other Plains

These soils make up about 5 percent of the survey area. About 80 percent of the acreage is rangeland. Maintaining forage production and controlling erosion are important management concerns.

14. Minnequa-Manvel-Penrose Association

Deep to shallow, well drained, nearly level to very steep, silty and loamy soils on dissected plains and other plains

This association is on dissected plains and other plains. Slopes are nearly level to steep in most areas, but they are very steep on some escarpments and ridges. The drainage pattern is well defined.

This association makes up about 2 percent of the survey area. It is about 35 percent Minnequa soils, 30 percent Manvel soils, 20 percent Penrose soils, and 15 percent minor soils.

The moderately deep, silty Minnequa soils are on the lower back slopes. Slopes range from 2 to 12 percent. Typically, the surface layer is grayish brown silt loam. The subsurface layer is pale brown silt loam. The underlying material is pale brown silt loam. Light yellowish brown and brownish yellow, interbedded, hard limestone and soft chalky shale bedrock is at a depth of about 26 inches. The soils are calcareous throughout.

The deep, silty Manvel soils are on foot slopes. Slopes range from 0 to 15 percent. Typically, the surface layer is grayish brown silt loam. The underlying material is light brownish gray and light gray silt loam. The soils are calcareous throughout.

The shallow, loamy Penrose soils are on shoulder slopes and the upper back slopes. Slopes range from 9 to 60 percent. Typically, the surface layer is very pale brown loam. The underlying material is very pale brown channery loam. Light gray, hard, interbedded limestone bedrock is at a depth of about 15 inches. The soils are calcareous throughout.

Minor in this association are Baca, Enning, Grummit, Nihill, and Pierre soils and Rock outcrop. The deep Baca soils are on foot slopes on terraces. They have more clay throughout than the Manvel soils. The shallow Enning soils are in landscape positions similar to those of the Penrose soils. They have chalky shale bedrock within a depth of 10 to 20 inches. The shallow, clayey Grummit soils are in landscape positions similar to those of the Penrose soils. They have more clay throughout than the Penrose soils and have acid shale bedrock at a depth of 10 to 20 inches. The deep, excessively drained Nihill soils are on back slopes on terrace scarps. They have gravel at a depth of about 10 inches. The moderately deep, clayey Pierre soils are on the less sloping, lower back slopes. The Rock outcrop is along the fronts of steep escarpments. It consists of exposures of limestone and shale.

Most of this association supports native grasses and is used as rangeland. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It generally is not suited to cultivated crops, tame pasture, or hay.

15. Cushman-Shingle Association

Moderately deep and shallow, well drained, moderately sloping to moderately steep, loamy soils on dissected plains

This association is on dissected plains. Slopes generally are moderately sloping to moderately steep but are steeper along some drainageways. The drainage pattern is well defined.

This association makes up about 3 percent of the survey area. It is about 45 percent Cushman soils, 40 percent Shingle soils, and 15 percent minor soils.

The moderately deep Cushman soils are on back slopes. Slopes range from 6 to 15 percent. Typically, the surface layer is brown loam. The subsoil is grayish brown and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is pale yellow, calcareous clay loam. Pale yellow and yellowish brown, soft, interbedded shale and sandstone bedrock is at a depth of about 29 inches.

The shallow Shingle soils are on shoulder slopes and the upper back slopes. Slopes range from 9 to 25 percent. Typically, the surface layer and underlying material are yellow loam. Very pale brown and yellow, soft, interbedded sandy shale and sandstone bedrock is at a depth of about 14 inches. The soils are calcareous throughout.

Minor in this association are Beckton, Nunn, Pierre, Samsil, and Satanta soils and Rock outcrop. The deep Beckton soils are on foot slopes on high terraces. They have a sodium-affected subsoil. The deep Nunn and

Satanta soils are on back slopes on high terraces. The moderately deep, clayey Pierre soils are in landscape positions similar to those of the Cushman soils. The shallow, clayey Samsil soils are in landscape positions similar to those of the Shingle soils. Pierre and Samsil soils have more clay than the major soils. The Rock outcrop is along the steeper ridges and the sides of deeply entrenched drainageways. It consists of exposures of soft shale and sandstone.

About 70 percent of this association supports native grasses and is used as rangeland. Some of the less sloping areas of the Cushman soils and some areas of the minor soils are used as cropland. Small grain and alfalfa are the main crops. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It generally is not suited to cultivated crops or to tame pasture and hay.

Nearly Level to Hilly, Loamy and Sandy Soils on Dissected Plains and Other Plains

These soils make up about 1 percent of the survey area. About 75 percent of the acreage is rangeland. Some of the less sloping areas are used as cropland. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Maintaining forage production, controlling erosion, and conserving moisture are important management concerns.

16. Jayem-Valent Association

Deep, well drained to excessively drained, nearly level to hilly, loamy and sandy soils on dissected plains and other plains

This association is on dissected plains and other plains. Slopes generally are nearly level to hilly.

This association makes up 1 percent of the survey area. It is about 45 percent Jayem soils, 35 percent Valent soils, and 20 percent minor soils.

The well drained, loamy Jayem soils are on back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is grayish brown fine sandy loam. The subsoil is brown and pale brown fine sandy loam. The underlying material is light yellowish brown loamy fine sand.

The excessively drained, sandy Valent soils are on shoulder slopes and the upper back slopes. Slopes range from 2 to 25 percent. Typically, the surface layer is brown loamy fine sand. The underlying material is light yellowish brown fine sand.

Minor in this association are Altvan, Nihill, Satanta, and Whitelake soils. The well drained Altvan soils are intermingled with the Jayem soils in the smooth, less sloping areas. They have gravelly material at a depth of 20 to 40 inches. The excessively drained Nihill soils are on back slopes on terraces. They have gravel within a depth of 10 inches. The well drained Satanta soils are in landscape positions similar to those of the Jayem soils. They have more clay in the subsoil than the Jayem soils. The sodium-affected Whitelake soils are in closed depressions.

About 75 percent of this association supports native grasses and is used as rangeland. A few of the less sloping areas of the Jayem soils are used as cropland. Small grain and alfalfa are the main crops. Maintaining forage production and controlling erosion are the major concerns in managing the rangeland. This association is suited to rangeland and to rangeland wildlife habitat. It generally is not suited to cultivated crops or to tame pasture and hay.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Satanta loam, 0 to 2 percent slopes, is a phase of the Satanta series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Orella-Interior-Badland complex, 0 to 25 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Badland is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The prairie parts of Custer and Pennington Counties are separated from the Black Hills parts by an escarpment locally called "the Hogback," which circles the Black Hills. The soils outside the Hogback are generally unique to the prairie and differ greatly from the soils in the Black Hills. Two surveys have been completed in the Hogback area. These surveys are separated by soil lines and have very few common areas. The names of some map units identified on the detailed soil maps of this survey area do not fully agree with those identified on the maps in the published soil surveys of Fall River, Haakon, Jackson, Meade, and Shannon Counties. Differences are the result of variations in the design and composition of the map units or changes and refinements in series concepts.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Soil Descriptions

AaA—Altvan loam, 0 to 2 percent slopes. This well drained, nearly level soil is on high terraces. It is moderately deep to gravelly material. Areas are irregular in shape and are 50 to 700 acres in size. Slopes are smooth.

Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is about 31 inches

thick. It is grayish brown, friable clay loam in the upper part and grayish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is yellowish brown, calcareous gravelly sand. In some areas the depth to gravelly sand is more than 40 inches.

Included with this soil in mapping are small areas of Nihill and Nunn soils. These soils make up less than 10 percent of any one mapped area. Nihill soils are on back slopes on high terrace scarps. They are less than 20 inches deep to gravelly material. Nunn soils are on the lower concave parts of the landscape. They have more clay in the subsoil than the Altvan soil and are more than 40 inches deep to gravelly material.

The content of organic matter is moderate in the Altvan soil. Permeability is moderate in the upper part of the soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. The underlying gravelly sand reduces the available water capacity and may limit productivity. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IVs-1; Silty range site; windbreak suitability group 6G.

AaB—Altvan loam, 2 to 6 percent slopes. This well drained, gently sloping soil is on high terraces. It is moderately deep to gravelly material. Areas are irregular in shape and are 40 to 200 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is about 31 inches thick. It is grayish brown, friable clay loam in the upper part and grayish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is yellowish brown, calcareous gravelly sand. In some areas the depth to gravelly sand is more than 40 inches.

Included with this soil in mapping are small areas of Nihill and Nunn soils. These soils make up less than 10 percent of any one mapped area. Nihill soils are on back slopes on high terrace scarps. They are less than 20 inches deep to gravelly material. Nunn soils are on the lower concave parts of the landscape. They have more clay in the subsoil than the Altvan soil and are more than 40 inches deep to gravelly material.

The content of organic matter is moderate in the Altvan soil. Permeability is moderate in the upper part of the soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

About half of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. The underlying gravelly sand reduces the available water capacity and may limit productivity. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling wind erosion and water erosion are important management concerns in cultivated areas. Minimizing tillage, stripcropping, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion and water erosion.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting on the contour helps to control water erosion.

The capability unit is IVe-2; Silty range site; windbreak suitability group 6G.

AaC—Altvan loam, 6 to 9 percent slopes. This well drained, moderately sloping soil is on high terraces. It is moderately deep to gravelly material. Areas are long and narrow and are 20 to 100 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is about 31 inches thick. It is grayish brown, friable clay loam in the upper part and grayish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is yellowish brown, calcareous gravelly sand. In some areas the depth to gravelly sand is more than 40 inches.

Included with this soil in mapping are small areas of Nihill and Schamber soils. These soils make up less than 15 percent of any one mapped area. They are on

shoulder slopes and back slopes on high terrace scarps. They are less than 20 inches deep to gravelly material.

The content of organic matter is moderate in the Altvan soil. Permeability is moderate in the upper part of the soil and very rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

Most of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is a hazard if the rangeland is overgrazed. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

This soil is not suited to cultivated crops because of the slope. It is suitable for tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The capability unit is VIe-2; Silty range site; windbreak suitability group 6G.

ArA—Arvada loam, 0 to 4 percent slopes. This deep, well drained, sodium-affected, nearly level and very gently sloping soil is on foot slopes on plains and on alluvial fans. Some areas have microrelief and are dissected by a meandering channel. Areas are long and narrow and are 20 to 120 acres in size. Slopes are long and smooth or slightly concave.

Typically, the surface layer is grayish brown loam about 2 inches thick. The subsoil is grayish brown and brown, firm clay loam about 19 inches thick. It is calcareous and has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay loam. It has accumulations of carbonate and salts throughout.

Included with this soil in mapping are small areas of Beckton, Kyle, Lohmiller, and Owanka soils and Slickspots. These included soils and Slickspots make up less than 10 percent of any one mapped area. Beckton soils are slightly higher on the landscape than the Arvada soil. Kyle and Owanka soils are in landscape positions similar to those of the Arvada soil. Lohmiller soils are slightly lower on the landscape than the Arvada soil. Beckton soils have a surface layer that is thicker and darker than that of the Arvada soil. Kyle, Lohmiller, and Owanka soils do not have a sodium-affected subsoil. Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is low in the Arvada soil. Permeability is very slow. Available water capacity is low. Runoff is slow. The shrink-swell potential is high. This soil has a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense, sodium-affected subsoil and a high content of salts in the subsoil are limitations.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

BaA—Baca silt loam, 0 to 4 percent slopes. This deep, well drained, very gently sloping soil is on foot slopes on terraces and alluvial fans. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 29 inches thick. It is light brownish gray and gray, friable and firm silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of Arvada, Kyle, and Manvel soils. These soils make up less than 15 percent of any one mapped area. The sodium-affected Arvada soils are in the slightly lower landscape positions. Kyle soils are in landscape positions similar to those of the Baca soil. They have more clay than the Baca soil. Manvel soils are in the slightly higher landscape positions. They have less clay in the subsoil than the Baca soil and are calcareous throughout.

The content of organic matter is moderate in the Baca soil. Permeability is moderately slow. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate.

Most of this acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. It is somewhat droughty. Alfalfa,

crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling wind erosion are important management concerns in cultivated areas. Minimizing tillage, stripcropping, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

Bb—Badland. This map unit consists of gently sloping to nearly vertical exposures of mudstone, siltstone, and shale. It is dissected by many intermittent drainageways. Areas are irregular in shape and are 40 to several thousand acres in size.

Included in this unit in mapping are small areas of Cedarpass, Conata, Interior, Orella, and Whitewater soils. These soils make up less than 15 percent of any one mapped area. The deep Cedarpass and Interior soils are near the base of the vertical mudstone exposures. The shallow Conata and Orella soils and the moderately deep Whitewater soils are in the less sloping vegetated areas and on the wider ridgetops.

Runoff is very rapid on the Badland. This map unit is subject to severe geologic erosion. It is unsuited to cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. Native grasses and cedar trees grow in some areas where landslides have occurred. These areas provide wildlife habitat and can be used as recreational areas, such as nature trails.

The capability unit is VIIIs-2; windbreak suitability group 10. No range site is assigned.

BcB—Bankard loamy fine sand, 0 to 4 percent slopes. This deep, somewhat excessively drained, nearly level and very gently sloping soil is on high flood plains (fig. 6). It is subject to rare flooding in most areas but is frequently flooded in some areas. Periods of flooding are very brief. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are smooth in most areas but are convex and hummocky in some areas.

Typically, the surface layer is light brownish gray loamy fine sand about 7 inches thick. The underlying material to a depth of 60 inches is light brownish gray loamy sand that has thin layers of sandy loam, fine sandy loam, and silt loam in the upper part and multicolored sand in the lower part. The soil is calcareous throughout. It contains about 5 percent coarse gravel.

Included with this soil in mapping are small areas of Glenberg, Haverson, and Lohmiller soils and Riverwash. These included soils and Riverwash make up less than 15 percent of any one mapped area. Glenberg and Haverson soils are in landscape positions similar to those of the Bankard soil. Glenberg soils have less coarse sand and more clay than the Bankard soil. Haverson soils have more clay and silt than the Bankard soil. Lohmiller soils are on the lower concave parts of the flood plains and in areas of backwater. They are clayey throughout. The Riverwash is adjacent to the stream channels. It supports little or no vegetation.

The content of organic matter is moderately low in the Bankard soil. Permeability is rapid. Available water capacity is low. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is used for grazing. This soil is suited to rangeland. Wind erosion is a hazard, and sand blowouts can form in overgrazed areas. Maintaining an adequate plant cover helps to prevent excessive wind erosion. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. The low available water capacity limits production, except during years of abnormally high rainfall. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling wind erosion are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but the low available water capacity limits the selection of species and optimum survival, growth, and vigor are unlikely. Planting in sod helps to control wind erosion.

The capability unit is IVe-6; Sands range site; windbreak suitability group 7.

BfA—Beckton silt loam, 0 to 4 percent slopes. This deep, moderately well drained, sodium-affected, very gently sloping soil is on foot slopes on high terraces. Areas are irregular in shape and are 30 to 150 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The subsurface layer is gray silt

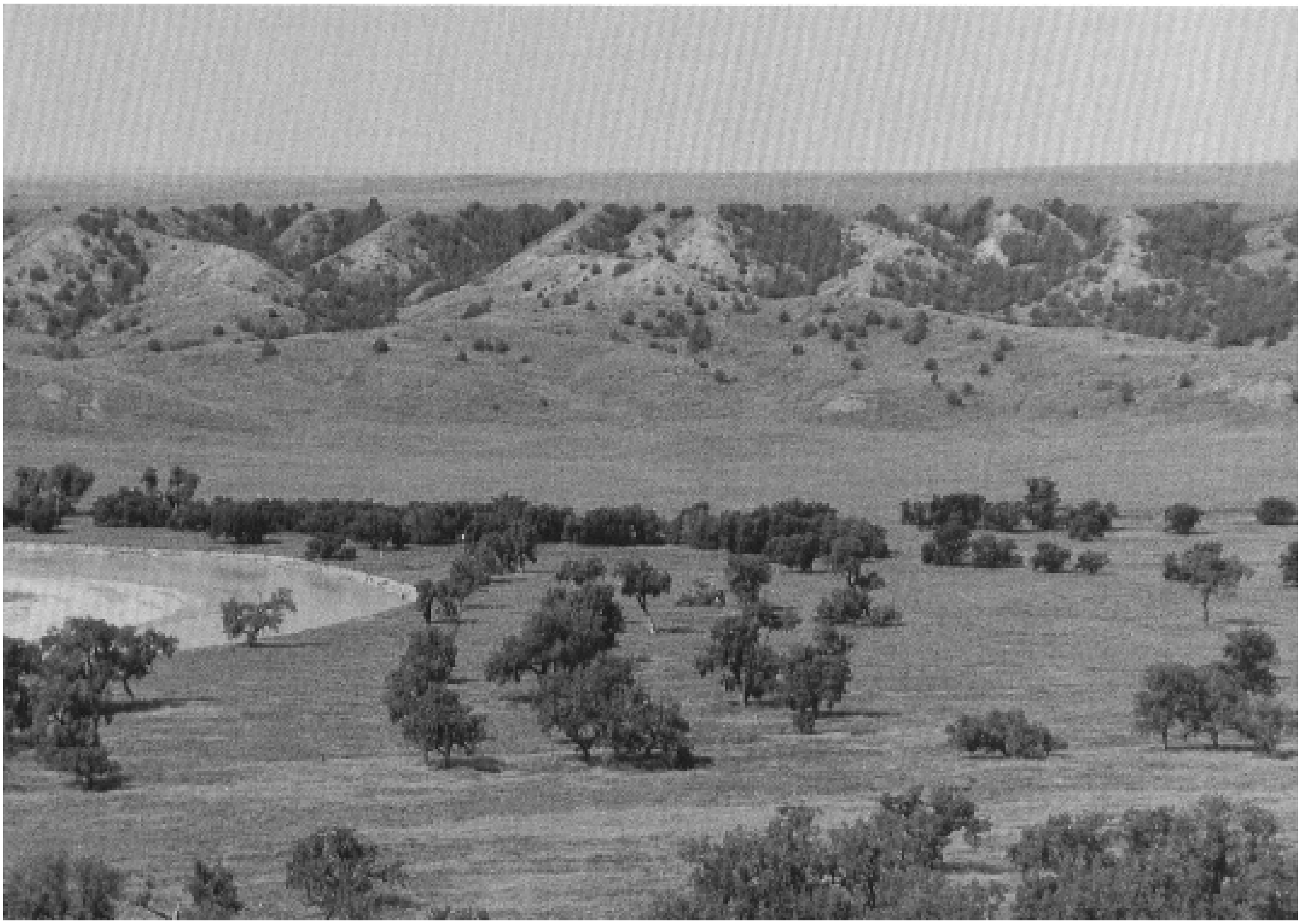

Figure 6.—An area of Bankard and Glenberg soils on the flood plain along the Cheyenne River. Pierre and Samsil soils and Rock outcrop are on the river breaks in the background.

loam about 2 inches thick. The subsoil is dark grayish brown, firm silty clay about 22 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown silty clay. It has accumulations of carbonate and salts.

Included with this soil in mapping are small areas of Arvada, Nunn, and Satanta soils. These soils make up less than 10 percent of any one mapped area. Arvada soils are in the slightly lower landscape positions. They do not have a dark surface layer. Nunn and Satanta soils are slightly higher on the landscape than the Beckton soil. They do not have a sodium-affected subsoil.

The content of organic matter is moderate in the Beckton soil. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high. This soil has a sodium-affected subsoil that adversely affects plant growth.

About half of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. The sodium-affected subsoil restricts crop growth. Alfalfa, crested wheatgrass, and western wheatgrass are examples of suitable pasture plants. Compaction and moisture conservation are important management concerns in cultivated areas. Minimizing

tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

This soil is suited to windbreaks and environmental plantings. The sodium-affected subsoil restricts root penetration. Trees and shrubs can be established, but optimum growth, survival, and vigor are unlikely.

The capability unit is IVs-2; Claypan range site; windbreak suitability group 9.

BhA—Beckton-Arvada complex, 0 to 4 percent slopes. These deep, sodium-affected, very gently sloping soils are on high terraces and alluvial fans. The Beckton soil is moderately well drained and is on the upper foot slopes. The Arvada soil is well drained and is on the lower foot slopes. Areas of this map unit are irregular in shape and are 40 to 100 acres in size. They are 45 to 55 percent Beckton soil and 35 to 45 percent Arvada soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Beckton soil is grayish brown silt loam about 4 inches thick. The subsurface layer is gray silt loam about 2 inches thick. The subsoil is dark grayish brown, firm silty clay about 22 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown silty clay. It has accumulations of carbonate and salts.

Typically, the surface layer of the Arvada soil is grayish brown loam about 2 inches thick. The subsoil is grayish brown and brown, firm clay loam about 19 inches thick. It is calcareous and has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay loam. It has accumulations of carbonate and salts throughout.

Included with these soils in mapping are small areas of Nunn, Razor, and Savo soils and Slickspots. These included soils and Slickspots make up less than 15 percent of any one mapped area. Nunn, Razor, and Savo soils are higher on the landscape than the Beckton and Arvada soils. They do not have a natric horizon. The Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderate in the Beckton soil and low in the Arvada soil. Permeability is slow in the Beckton soil and very slow in the Arvada soil. Available water capacity is moderate in the Beckton soil and low in the Arvada soil. Runoff is slow on both soils. The shrink-swell potential is high. These soils have a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

The Beckton soil is suited to cultivated crops and to tame pasture and hay, and the Arvada soil generally is unsuited. Alfalfa, western wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. The dense, sodium-affected subsoil is a limitation in cultivated areas. Compaction and moisture conservation are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

The Beckton soil is suited to windbreaks and environmental plantings, and the Arvada soil generally is unsuited. The sodium-affected subsoil is a limitation. Trees and shrubs can be established on the Beckton soil, but optimum growth, survival, and vigor are unlikely. No trees or shrubs grow well in areas of the Arvada soil.

The Beckton soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9. The Arvada soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

BkA—Blackpipe silty clay loam, 0 to 2 percent slopes. This moderately deep, well drained, nearly level soil is on summits and back slopes on plains. Areas are irregular in shape and are 40 to 1,000 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown silty clay loam about 5 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown, olive brown, and light olive brown, friable silty clay. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous silty clay loam. Multicolored, soft, interbedded sandstone and shale bedrock is at a depth of about 27 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Cushman, Satanta, and Wortman soils. These soils make up less than 15 percent of any one mapped area. Cushman soils are on the slightly higher parts of the landscape. They have a light colored surface layer. Satanta soils are in landscape positions similar to those of the Blackpipe soil. They have less clay in the subsoil than the Blackpipe soil and do not have bedrock within a depth of 40 inches. The sodium-affected Wortman soils are on the slightly lower parts of the landscape.

The content of organic matter is moderate in the Blackpipe soil. Permeability is moderately slow.

Available water capacity is low. Runoff is slow. The shrink-swell potential is high in the upper part of the subsoil and moderate in the lower part.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. It is somewhat droughty. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 6R.

BkB—Blackpipe silty clay loam, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on back slopes on plains. Areas are irregular in shape and are 100 to 300 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown silty clay loam about 5 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown, olive brown, and light olive brown, friable silty clay. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous silty clay loam. Multicolored, soft, interbedded sandstone and shale bedrock is at a depth of about 27 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Cushman, Satanta, and Wortman soils. These soils make up less than 15 percent of any one mapped area. Cushman soils are on the slightly higher parts of the landscape. They have a light colored surface layer. Satanta soils are in landscape positions similar to those of the Blackpipe soil. They have less clay in the subsoil than the Blackpipe soil and do not have bedrock within a depth of 40 inches. The sodium-affected Wortman soils are on the slightly lower parts of the landscape.

The content of organic matter is moderate in the Blackpipe soil. Permeability is moderately slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high in the upper part of the subsoil and moderate in the lower part.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. It is somewhat droughty. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling wind erosion and water erosion are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, stripcropping, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion and water erosion.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 6R.

BlA—Blackpipe clay loam, 0 to 2 percent slopes. This moderately deep, well drained, nearly level soil is on summits and back slopes on plains. Areas are irregular in shape and are 100 to 500 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown clay loam about 5 inches thick. The subsoil is about 24 inches thick. It is grayish brown, firm clay in the upper part and grayish brown and light brownish gray, firm, calcareous clay loam in the lower part. White, calcareous, soft mudstone bedrock is at a depth of about 29 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the soil is calcareous at or near the surface.

Included with this soil in mapping are small areas of Norrest, Wanblee, and Wortman soils. These soils make up less than 15 percent of any one mapped area. Norrest soils are slightly higher on the landscape than the Blackpipe soil. They have a light colored surface layer. The sodium-affected Wanblee and Wortman soils are on the slightly lower parts of the landscape.

The content of organic matter is moderate in the Blackpipe soil. Permeability is moderately slow. Available water capacity is low. Runoff is slow. The shrink-swell potential is high in the upper part of the subsoil and moderate in the lower part.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. It is somewhat droughty. Alfalfa, intermediate wheatgrass, and crested wheatgrass are suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 6R.

BlB—Blackpipe clay loam, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on back slopes on plains. Areas are irregular in shape and are 100 to 400 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown clay loam about 5 inches thick. The subsoil is about 24 inches thick. It is grayish brown, firm clay in the upper part and grayish brown and light brownish gray, firm, calcareous clay loam in the lower part. White, calcareous, soft mudstone bedrock is at a depth of about 29 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the soil is calcareous at or near the surface.

Included with this soil in mapping are small areas of Norrest, Wanblee, and Wortman soils. These soils make up less than 15 percent of any one mapped area. Norrest soils are slightly higher on the landscape than the Blackpipe soil. They have a light colored surface layer. The sodium-affected Wanblee and Wortman soils are on the slightly lower parts of the landscape.

The content of organic matter is moderate in the Blackpipe soil. Permeability is moderately slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high in the upper part of the subsoil and moderate in the lower part.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. It is somewhat droughty. Alfalfa, intermediate wheatgrass, and crested wheatgrass are suitable pasture plants. Conserving moisture and controlling wind erosion and water erosion are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, stripcropping, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion and water erosion.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 6R.

BnC—Blackpipe-Norrest complex, 6 to 12 percent slopes. These moderately deep, well drained, moderately sloping and strongly sloping soils are on dissected plains. The Blackpipe soil is on the lower back slopes. The Norrest soil is on the upper back slopes. Areas of this map unit are irregular in shape and are 50 to 200 acres in size. They are 45 to 55 percent Blackpipe soil and 25 to 35 percent Norrest soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Blackpipe soil is dark grayish brown clay loam about 5 inches thick. The subsoil is about 24 inches thick. It is grayish brown, firm silty clay in the upper part and grayish brown and light brownish gray, firm, calcareous clay loam in the lower part. White, calcareous, soft mudstone bedrock is at a depth of about 29 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the soil is calcareous at or near the surface.

Typically, the surface layer of the Norrest soil is dark grayish brown silty clay loam about 4 inches thick. The subsoil is light brownish gray, friable silty clay about 14 inches thick. It has accumulations of carbonate in the lower part. The underlying material is white clay loam. It contains 30 percent, by volume, soft fragments of mudstone. Very pale brown, soft mudstone bedrock is at a depth of about 29 inches. The soil is calcareous throughout. In some areas carbonates are leached to a depth of more than 20 inches.

Included with these soils in mapping are small areas of Fairburn, Wanblee, and Wortman soils. These included soils make up less than 15 percent of any one mapped area. Fairburn soils are on the higher parts of the landscape. They are less than 20 inches deep over bedrock. The sodium-affected Wanblee and Wortman soils are on the slightly lower parts of the landscape.

The content of organic matter is moderate in the Blackpipe soil and low in the Norrest soil. Permeability is moderately slow in both soils. Available water capacity is low. Runoff is medium. In the Blackpipe soil, the shrink-swell potential is high in the upper part of the subsoil and moderate in the lower part. In the Norrest soil, it is high.

About half of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem in areas of the Norrest soil. Restricted grazing during wet periods helps to prevent compaction. Proper

stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Water erosion is a hazard if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

The Blackpipe soil is suited to cultivated crops, and the Norrest soil generally is unsuited. The slope is a limitation. These soils are suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Controlling water erosion and conserving soil moisture are important management concerns in cultivated areas of the Blackpipe soil. Contour farming, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control water erosion and conserve moisture. The Norrest soil generally is not suited to cultivated crops because of the slope.

These soils are suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The Blackpipe soil is in capability unit IVe-1 and Silty range site. The Norrest soil is in capability unit VIe-3 and Clayey range site. Both soils are in windbreak suitability group 6R.

BoA—Blackpipe-Wortman complex, 0 to 3 percent slopes. These moderately deep, well drained, nearly level soils are on plains. The Blackpipe soil is on summits and back slopes. The sodium-affected Wortman soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 40 to 1,000 acres in size. They are 50 to 60 percent Blackpipe soil and 30 to 40 percent Wortman soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Blackpipe soil is dark grayish brown silty clay loam about 5 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown, olive brown, and light olive brown, friable silty clay. It is calcareous in the lower part. The underlying material is light yellowish brown, calcareous silty clay loam. Multicolored, soft, interbedded sandstone and shale bedrock is at a depth of about 27 inches. In some areas the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Wortman soil is grayish brown silt loam about 6 inches thick. The subsurface layer is grayish brown silt loam about 3 inches thick. The subsoil is dark grayish brown and brown, very firm silty clay about 12 inches thick. It is calcareous in the lower part. The underlying material is pale brown, calcareous silty clay loam. Accumulations of salts are in the lower part of the subsoil and in the underlying material. Multicolored, soft, interbedded sandstone and shale bedrock is at a depth of about 32 inches. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Hoven, Satanta, and Wanblee soils. These included soils make up less than 15 percent of any one mapped area. The poorly drained, sodium-affected Hoven soils are in closed depressions. Satanta soils are in landscape positions similar to those of the Blackpipe soil. They have less clay than the Blackpipe and Wortman soils and do not have bedrock within a depth of 40 inches. Wanblee soils are in landscape positions similar to those of the Wortman soil. They have a light colored surface layer.

The content of organic matter is moderate in the Blackpipe and Wortman soils. Permeability is moderately slow in the Blackpipe soil and very slow in the Wortman soil. Available water capacity is low in both soils. Runoff is slow. The shrink-swell potential is high in the upper part of the subsoil and moderate in the lower part. The Wortman soil has a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. The sodium-affected subsoil restricts crop growth in areas of the Wortman soil. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Compaction and moisture conservation are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

These soils are suited to rangeland. No hazards or limitations affect the use of the Blackpipe soil for grazing. Compaction is a problem in areas of the Wortman soil. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to windbreaks and environmental plantings. The Blackpipe soil is somewhat droughty, and the sodium-affected subsoil restricts root penetration in areas of the Wortman soil. Trees and shrubs can be established on these soils, but optimum survival, growth, and vigor are unlikely.

The Blackpipe soil is in capability unit IIIc-1, Silty range site, and windbreak suitability group 6R. The Wortman soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

BoB—Blackpipe-Wortman complex, 1 to 6 percent slopes. These moderately deep, well drained, nearly level and gently sloping soils are on plains. The Blackpipe soil is on back slopes. The sodium-affected Wortman soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 50 to 400 acres in size. They are 45 to 55 percent Blackpipe soil and 35 to 45 percent Wortman soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Blackpipe soil is dark grayish brown clay loam about 5 inches thick. The subsoil is about 24 inches thick. It is grayish brown, firm clay in the upper part and grayish brown and light brownish gray, firm, calcareous clay loam in the lower part. White, calcareous, soft mudstone bedrock is at a depth of about 29 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the soil is calcareous at or near the surface.

Typically, the surface layer of the Wortman soil is grayish brown silt loam about 5 inches thick. The subsoil is about 29 inches thick. It is dark grayish brown silty clay in the upper part; grayish brown, calcareous silty clay in the next part; and light brownish gray, calcareous silty clay loam in the lower part. Light gray, soft siltstone bedrock is at a depth of about 34 inches. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Norrest and Wanblee soils. These included soils make up less than 10 percent of any one mapped area. Norrest soils are on the slightly higher parts of the landscape. They do not have a dark surface layer. Wanblee soils are in landscape positions similar to those of the Wortman soil. They do not have a dark surface layer.

The content of organic matter is moderate in the Blackpipe and Wortman soils. Permeability is moderately slow in the Blackpipe soil and very slow in the Wortman soil. Available water capacity is low in both soils. Runoff is medium on the Blackpipe soil and slow on the Wortman soil. The shrink-swell potential is high in the upper part of the subsoil of both soils and moderate in the lower part. The Wortman soil has a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is used for grazing. These soils are suited to rangeland. No hazards or limitations affect the use of the Blackpipe soil for grazing. Compaction is a problem in areas of the Wortman soil. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to cultivated crops and to tame pasture and hay. The sodium-affected subsoil restricts crop growth in areas of the Wortman soil. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Wind erosion, water erosion, and compaction are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, stripcropping, and subsoiling or deep chiseling help to control wind erosion and water erosion and prevent compaction.

These soils are suited to windbreaks and environmental plantings. The Blackpipe soil is somewhat droughty, and the sodium-affected subsoil restricts root penetration in areas of the Wortman soil. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The Blackpipe soil is in capability unit IIIe-1, Silty range site, and windbreak suitability group 6R. The Wortman soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

Bp—Bridgeport silt loam. This deep, well drained, nearly level soil is on high flood plains. It is subject to rare flooding for very brief periods. Areas are broad and long in shape and are 40 to 200 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark gray silt loam about 9 inches thick. The subsoil is brown, friable silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches is silt loam. It is brown in the upper part and grayish brown in the lower part. The soil is calcareous throughout. In some areas the soil has more sand throughout.

Included with this soil in mapping are small areas of Egas, Haverson, and Owanka soils. These soils make up less than 15 percent of any one mapped area. The poorly drained Egas soils have accumulations of salts throughout and are on low flood plains. Haverson soils are in landscape positions similar to those of the Bridgeport soil. They have a dark surface layer that is thinner than that of the Bridgeport soil. Owanka soils have more clay than the Bridgeport soil and are in the slightly higher landscape positions.

The content of organic matter is moderate in the Bridgeport soil. Permeability is moderate. Available water capacity is very high. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving

moisture is an important concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well.

The capability unit is IIIc-1; Loamy Terrace range site; windbreak suitability group 1.

Ca—Cactusflat silty clay. This deep, well drained, nearly level soil is on foot slopes on alluvial fans. Areas are irregular in shape and are 40 to 200 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown silty clay about 4 inches thick. The subsoil is about 18 inches thick. It is gray, firm silty clay and clay. The underlying material to a depth of 60 inches is white, stratified silty clay loam, clay loam, and very fine sandy loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Interior, Kyle, and Weta soils. These soils make up less than 10 percent of any one mapped area. Interior soils are on high flood plains. They have less clay in the subsoil than the Cactusflat soil. Kyle soils are in landscape positions similar to those of the Cactusflat soil. They are clayey. The sodium-affected Weta soils are on the slightly lower parts of the landscape.

The content of organic matter is moderate in the Cactusflat soil. Permeability is slow in the subsoil and moderately slow in the underlying material. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high in the subsoil and moderate in the underlying material.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. It can become compacted if cultivated when wet. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Controlling wind erosion, preventing compaction, and conserving moisture are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture, prevent compaction, and control wind erosion.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IIIs-1; Clayey range site; windbreak suitability group 4C.

Cb—Cactusflat-Weta complex. These deep, well drained, nearly level soils are on alluvial fans. The Cactusflat soil is on the upper foot slopes. The sodium-affected Weta soil is on the lower foot slopes. Areas of this map unit are irregular in shape and are 20 to 250 acres in size. They are 40 to 50 percent Cactusflat soil and 35 to 45 percent Weta soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Cactusflat soil is dark grayish brown silty clay about 4 inches thick. The subsoil is about 18 inches thick. It is gray, firm silty clay and clay. The underlying material to a depth of 60 inches is white, stratified silty clay loam, clay loam, and very fine sandy loam. The soil is calcareous throughout.

Typically, the surface layer of the Weta soil is light brownish gray silt loam about 3 inches thick. The subsoil is about 18 inches thick. It is dark grayish brown, very firm clay in the upper part and brown, firm, calcareous silty clay loam in the lower part. It has accumulations of salts and carbonate in the lower part. The underlying material to a depth of 60 inches is pale brown and light gray, stratified, calcareous silty clay loam, silt loam, and loam. In some areas the subsoil contains less sodium.

Included with these soils in mapping are small areas of Blackpipe, Cedarpass, and Wortman soils. These included soils make up less than 15 percent of any one mapped area. Blackpipe soils are on the slightly higher parts of the landscape. The sodium-affected Wortman soils are in landscape positions similar to those of the Weta soil. Blackpipe and Wortman soils are 20 to 40 inches deep over bedrock. Cedarpass soils are in landscape positions similar to those of the Cactusflat soil. They have less clay in the subsoil than the Cactusflat and Weta soils.

The content of organic matter is moderate in the Cactusflat soil and moderately low in the Weta soil. Permeability is slow in the subsoil of the Cactusflat soil and very slow in the subsoil of the Weta soil. It is moderately slow in the underlying material of both soils. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high in the subsoil of the Cactusflat soil and high in the subsoil of the Weta soil. It is moderate in the underlying material of both soils. The Weta soil has a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

The Cactusflat soil is suited to cultivated crops, and the Weta soil generally is unsuited. The sodium-affected subsoil in the Weta soil restricts root penetration. Conserving moisture, preventing compaction, and controlling wind erosion are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, stripcropping, and subsoiling or deep chiseling help to prevent compaction, conserve moisture, and control wind erosion.

The Cactusflat soil is suited to tame pasture and hay, and the Weta soil generally is unsuited. The sodium-affected subsoil is a limitation in areas of the Weta soil. Alfalfa, western wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants.

The Cactusflat soil is suited to windbreaks and environmental plantings, and the Weta soil generally is unsuited. The clayey subsoil of the Cactusflat soil can restrict the penetration of plant roots. The sodium-affected subsoil is a limitation in areas of the Weta soil. Trees and shrubs can be established on the Cactusflat soil, but optimum growth is unlikely. No trees or shrubs grow well on the Weta soil.

The Cactusflat soil is in capability unit IIIs-1, Clayey range site, and windbreak suitability group 4C. The Weta soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

CeA—Cedarpass silty clay loam, 0 to 3 percent slopes. This deep, well drained, sodium-rich, nearly level soil is on summits on terraces. Areas are irregular in shape and are 40 to 600 acres in size. Slopes are smooth.

Typically, the surface layer is grayish brown silty clay loam about 5 inches thick. The subsoil is light brownish gray and light gray, friable silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches is white and light brownish gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas clay or mudstone is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Denby, Interior, and Whitewater soils. These soils make up less than 15 percent of any one mapped area. Denby soils are in landscape positions similar to those of the Cedarpass soil. They have more clay than the Cedarpass soil. Interior soils are on high flood plains. They are stratified throughout. Whitewater soils are on the higher parts of the landscape. They have more clay than the Cedarpass soil and are 20 to 40 inches deep over bedrock.

The content of organic matter is moderate in the Cedarpass soil. Permeability is moderate. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate. This soil has a high content of sodium that adversely affects the growth of most cultivated crops.

Most of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. The high content of sodium is a limitation. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling wind erosion are important management concerns in cultivated areas. Including grasses and legumes in the cropping system, leaving crop residue on the surface, stripcropping, and minimizing tillage help to conserve moisture and control wind erosion.

This soil is suited to windbreaks and environmental plantings. The high content of sodium is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IVe-10; Silty range site; windbreak suitability group 8.

CfA—Cedarpass-Denby complex, 0 to 3 percent slopes. These deep, well drained, sodium-rich, nearly level soils are on terraces. The Cedarpass soil is on slightly convex summits. The Denby soil is on smooth or slightly concave summits. Areas of this map unit are elongated and are 40 to 250 acres in size. They are 50 to 60 percent Cedarpass soil and 30 to 40 percent Denby soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Cedarpass soil is grayish brown silty clay loam about 5 inches thick. The subsoil is light brownish gray and light gray, friable silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches is white and light brownish gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas clay or mudstone bedrock is at a depth of 20 to 40 inches.

Typically, the surface layer of the Denby soil is light brownish gray silty clay about 3 inches thick. The subsoil is about 23 inches thick. It is light brownish gray and light gray, very firm and firm clay and clay loam. The underlying material to a depth of 60 inches is light gray, stratified silty clay loam. The soil is calcareous

Figure 7.—Range in an area of the Cedarpass-Denby complex, 0 to 3 percent slopes. Badland is in the background.

throughout. In some areas mudstone bedrock is at a depth of 20 to 40 inches.

Included with these soils in mapping are small areas of Interior, Whitewater, and Wanblee soils. These included soils make up less than 15 percent of any one mapped area. Interior soils are on high flood plains. They are more stratified than the Cedarpass soil. Whitewater and Wanblee soils are on the higher parts of the landscape. They are 20 to 40 inches deep over bedrock. Wanblee soils have a sodium-affected subsoil.

The content of organic matter is moderate in the Cedarpass and Denby soils. Permeability is moderate in the Cedarpass soil. It is slow in the upper part of the Denby soil and moderately slow in the underlying material. Available water capacity is high in the Cedarpass soil and moderate in the Denby soil. Runoff is slow on both soils. The shrink-swell potential is moderate in the Cedarpass soil. It is high in the subsoil of the Denby soil and moderate in the underlying material. These soils have a high content of sodium that adversely affects the growth of most cultivated plants.

Most of the acreage is used for grazing (fig. 7). These soils are suited to rangeland. Compaction is a problem in areas of the Denby soil. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to cultivated crops and to tame pasture and hay. The high content of sodium is a

limitation. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. The Denby soil can become compacted if cultivated when wet. Conserving moisture, preventing compaction, and controlling wind erosion are important management concerns in cultivated areas. Leaving crop residue on the surface, minimizing tillage, stripcropping, and subsoiling or deep chiseling help to conserve moisture, prevent compaction, and control wind erosion.

These soils are suited to windbreaks and environmental plantings. The high content of sodium is a limitation. The Denby soil takes in water slowly, and the clayey subsoil in both soils can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The Cedarpass soil is in capability unit IVe-10, Silty range site, and windbreak suitability group 8. The Denby soil is in capability unit IVs-6, Clayey range site, and windbreak suitability group 4C.

Ch—Cedarpass-Interior-Badland complex. This map unit consists of deep, well drained, sodium-rich, nearly level and gently sloping soils and steep areas of Badland. It is on terraces that are dissected by flood plains. The Cedarpass soil is on nearly level summits on mesas or plateaus that are 3 to 20 feet above the Interior soil. The Interior soil is on high flood plains. It is frequently flooded for brief periods. The Badland is along edges of the flood plains and on high parts of the landscape. Areas of this map unit are irregular in shape and are 20 to 450 acres in size. They are 40 to 50 percent Cedarpass soil, 25 to 35 percent Interior soil, and 15 to 25 percent Badland. The two soils and Badland occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Cedarpass soil is grayish brown silty clay loam about 5 inches thick. The subsoil is light brownish gray and light gray, friable silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches is white and light brownish gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas clay or mudstone bedrock is at a depth of 20 to 40 inches.

Typically, the surface layer of the Interior soil is light gray loam about 2 inches thick. The underlying material to a depth of 60 inches is white and light gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas the surface layer is silty clay.

The Badland consists of exposures of the Brule, Chadron, and Pierre Formations. It is on mounds, pinnacles, and escarpments. It supports little or no vegetation.

Included in this unit in mapping are small areas of Denby and Orella soils. These soils make up less than 15 percent of any one mapped area. Denby soils are in landscape positions similar to those of the Cedarpass soil. They have more clay than the Cedarpass soil. Orella soils are on vegetated shoulder slopes and back slopes above the Cedarpass and Interior soils. They are 10 to 20 inches deep over mudstone bedrock.

The content of organic matter is moderate in the Cedarpass soil and low in the Interior soil. Permeability is moderate in both soils. Available water capacity is high. Runoff is slow on the Cedarpass and Interior soils and rapid on the Badland. The shrink-swell potential is moderate in the Cedarpass soil and low in the Interior soil. These soils have a high content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. These soils are suited to rangeland, but some small areas of the Cedarpass soil are inaccessible to livestock because they are on small mesas that have perpendicular sides. The Badland does not support grazable vegetation.

This map unit generally is unsuited to cultivated crops and to tame pasture and hay. The Badland and deep drainageways divide the soils into many small tracts that are not accessible to modern farming equipment. The high content of sodium also is a limitation.

Windbreaks and environmental plantings can be planted in areas of the Cedarpass soil. Inaccessibility and the high content of sodium in the subsoil are limitations. Trees and shrubs can be established, but optimum growth and vigor are unlikely. The Interior soil and the Badland are unsuited to windbreaks and environmental plantings.

The Cedarpass soil is in capability unit IVe-10, Silty range site, and windbreak suitability group 8. The Interior soil is in capability unit VIs-7, Badland Overflow range site, and windbreak suitability group 10. The Badland is in capability unit VIIIs-2 and windbreak suitability group 10. It is not assigned a range site.

ClF—Colby silt loam, 9 to 40 percent slopes. This deep, strongly sloping to steep, well drained soil is on back slopes on dissected plains. Areas are irregular in shape and are 15 to 320 acres in size. Slopes are convex.

Typically, the surface layer is pale brown, calcareous silt loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown, calcareous silt loam. It has accumulations of carbonate.

Included with this soil in mapping are small areas of Norka, Samsil, and Schamber soils. These soils make up less than 10 percent of any one mapped area. Norka soils are on the lower parts of the landscape. They have a surface layer and subsoil that are thicker and

darker than those of the Colby soil. Samsil soils are along side slopes of entrenched drainageways. They are 10 to 20 inches deep over shale bedrock. Schamber soils are along terrace escarpments. They are gravelly sand throughout.

The content of organic matter is low in the Colby soil. Permeability is moderate. Available water capacity is high. Runoff is medium or rapid.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is a management concern if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope.

The capability unit is VIIe-1; Thin Upland range site; windbreak suitability group 10.

CmC—Colby-Norka silt loams, 6 to 15 percent slopes. These deep, well drained, moderately sloping and strongly sloping soils are on dissected plains. Slopes are convex. The Colby soil is on strongly sloping back slopes and summits. The Norka soil is on moderately sloping foot slopes. Areas of this map unit are irregular in shape and are 40 to 250 acres in size. They are 55 to 65 percent Colby soil and 25 to 35 percent Norka soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Colby soil is pale brown, calcareous silt loam about 6 inches thick. The underlying material to a depth of 60 inches is also pale brown, calcareous silt loam. It has accumulations of carbonate.

Typically, the surface layer of the Norka soil is dark grayish brown silt loam about 4 inches thick. The next 3 inches is also dark grayish brown silt loam. The subsoil is about 11 inches thick. It is grayish brown, firm silty clay loam in the upper part and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous, stratified silt loam.

Included with these soils in mapping are small areas of Nihill, Pierre, and Savo soils. These included soils make up less than 15 percent of any one mapped area. Nihill soils are on back slopes along entrenched drainageways. They are gravelly throughout. Pierre soils are on the back slopes of entrenched drainageways below the Colby and Norka soils. They are clayey throughout and have shale at a depth of 20 to 40 inches. Savo soils are in landscape positions similar to those of the Norka soil. They have more clay in the subsoil than the Norka soil.

The content of organic matter is low in the Colby soil and moderate in the Norka soil. Permeability is moderate in both soils. Available water capacity is high. Runoff is medium. The shrink-swell potential is low in the Colby soil. It is moderate in the subsoil of the Norka soil and low in the underlying material.

All of the acreage is used for grazing. These soils are suited to rangeland. Water erosion is a management concern if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to tame pasture and hay and to windbreaks and environmental plantings. Generally, the Colby soil is not suited to cultivated crops because of the slope. A high content of lime in the surface layer of the Colby soil limits fertility. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Trees and shrubs can be established, but optimum growth and survival are unlikely in areas of the Colby soil. Planting trees on the contour helps to control water erosion.

The Colby soil is in capability unit VIe-3, Thin Upland range site, and windbreak suitability group 8. The Norka soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 3.

Cn—Colombo loam. This deep, well drained, nearly level soil is on high flood plains. It is subject to rare flooding for brief periods. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 6 inches thick. The underlying material to a depth of 60 inches is brown, yellowish brown, and light gray, stratified very fine sandy loam, loam, and sandy clay loam. The soil is calcareous throughout. In some areas dark colors extend to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Bridgeport, Egas, Haverson, and Owanka soils. These soils make up less than 15 percent of any one mapped area. Bridgeport and Haverson soils are in landscape positions similar to those of the Colombo soil. Bridgeport soils have less sand throughout than the Colombo soil. Haverson soils have a surface layer that is lighter colored than that of the Colombo soil. The poorly drained Egas soils have accumulations of salts at or near the surface. They are on the slightly higher

parts of the landscape. Owanka soils have more clay and less sand than the Colombo soil. They are on the higher parts of the landscape.

The content of organic matter is moderately low in the Colombo soil. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Leaving crop residue on the surface and minimizing tillage help to conserve moisture. In some years floodwater may delay planting, but in most years the additional moisture is beneficial and flood damage is minor.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 1.

Co—Colombo loam, channeled. This deep, well drained, nearly level soil is on high flood plains that are dissected into small tracts by narrow stream channels. It is occasionally flooded for brief periods. Areas are long and narrow and are 10 to 320 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 6 inches thick. The underlying material to a depth of 60 inches is brown, yellowish brown, and light gray, stratified very fine sandy loam, loam, and sandy clay loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Bridgeport, Haverson, and Lohmiller soils. These soils make up less than 10 percent of any one mapped area. They are in landscape positions similar to those of the Colombo soil. Bridgeport soils have less sand throughout than the Colombo soil. Haverson and Lohmiller soils have a surface layer that is lighter colored than that of the Colombo soil. Lohmiller soils have more clay than the Colombo soil. In some places cattails, reeds, and other aquatic vegetation grow in slow meanders and along streambanks.

The content of organic matter is moderately low in the Colombo soil. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is used for grazing or hay. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Green ash, American elm, cottonwood, chokecherry, buffaloberry, and willow grow adjacent to streams in many areas.

This soil generally is unsuited to cultivated crops because it is dissected into small tracts that are subject to spring flooding. It is suited to tame pasture and hay, but harvesting is difficult because of the channeled landscape. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Because the meandering stream channels can hinder planting by machine, hand planting may be needed.

The capability unit is VIw-1; Loamy Overflow range site; windbreak suitability group 1.

Cp—Colombo-Urban land complex. This map unit consists of a deep, well drained, nearly level Colombo soil and areas of Urban land. It is on high flood plains along Rapid Creek. It is subject to rare flooding for brief periods. Only one map unit, approximately 1,080 acres in size, is in the survey area. It is 55 percent Colombo soil and 35 percent Urban land. The Colombo soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not possible.

Typically, the surface layer of the Colombo soil is dark grayish brown loam about 8 inches thick. The subsurface layer is brown loam about 6 inches thick. The underlying material to a depth of 60 inches is brown, yellowish brown, and light gray, stratified very fine sandy loam, loam, and sandy clay loam. The soil is calcareous throughout.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are commercial or industrial. In some areas there are single family houses and apartments.

Included in this unit in mapping are small areas of Bridgeport and Satanta soils. These soils make up less than 15 percent of any one mapped area. Bridgeport soils are in landscape positions similar to those of the Colombo soil. They have less sand throughout than the Colombo soil. Satanta soils are on the slightly higher parts of the landscape. They are not stratified and have more clay in the subsoil than the Colombo soil.

The content of organic matter is moderately low in the Colombo soil. Permeability is moderate. Available

water capacity is high. Runoff is slow on the Colombo soil and rapid on the Urban land.

The Colombo soil is well suited to lawns, gardens, and recreational development. Most areas are used for recreation. These areas include parks, ball diamonds, gardens, golf courses, and places for fishing. Lawns, trees, ornamental shrubs, flower gardens, and vegetable gardens generally are successful. Irrigation during droughty periods and regular additions of fertilizer help to achieve optimum growth. In areas where cutting has exposed the subsoil or underlying material, adding organic matter to the soil and mulching can improve the seedbed.

This map unit is poorly suited to sanitary facilities and building sites because of the hazard of flooding. The base material for streets and roads needs to be strengthened to support vehicular traffic.

No interpretive groups are assigned to this unit.

CuD—Conata-Hisle complex, 6 to 25 percent slopes. These well drained, moderately sloping to moderately steep soils are on dissected plains. The shallow Conata soil is on the upper back slopes and convex summits. The moderately deep, sodium-affected Hisle soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 80 to 200 acres in size. They are 45 to 55 percent Conata soil and 35 to 45 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Conata soil is brown silty clay about 3 inches thick. The subsoil is brown and grayish brown, calcareous silty clay about 11 inches thick. It contains few fine and medium fragments of shale throughout. Multicolored, soft, calcareous shale bedrock is at a depth of about 14 inches.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 2 inches thick. The subsoil is brown and pale brown, very firm, calcareous silty clay about 19 inches thick. It has accumulations of carbonate and salts in the lower part. The underlying material is pale brown, calcareous silty clay. Light gray, calcareous, soft shale bedrock is at a depth of about 28 inches. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Larvie and Pierre soils and Slickspots. These included soils and Slickspots make up less than 15 percent of any one mapped area. The moderately deep Larvie and Pierre soils are in landscape positions similar to those of the Hisle soil. They do not have a sodium-affected subsoil. The Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderately low in the Conata and Hisle soils. Permeability is very slow. Available water capacity is very low. Runoff is rapid on the Conata soil and medium on the Hisle soil. The shrink-swell potential is very high in both soils. The Hisle soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. These soils are suited to rangeland. Water erosion and compaction are important management concerns. Restricted grazing during wet periods helps to prevent compaction. Water erosion is a hazard if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing help to maintain maximum forage production and control water erosion.

This map unit generally is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope. The shallowness to shale in the Conata soil and the sodium-affected subsoil in the Hisle soil are limitations.

The Conata soil is in capability unit VIe-12 and Shallow Clay range site. The Hisle soil is in capability unit VIs-3 and Thin Claypan range site. Both soils are in windbreak suitability group 10.

CyC—Cushman loam, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on back slopes on dissected plains. Areas are irregular in shape and are 40 to 300 acres in size. Slopes are convex.

Typically, the surface layer is brown loam about 3 inches thick. The subsoil is grayish brown and light yellowish brown, friable clay loam about 13 inches thick. It is calcareous in the lower part. The underlying material is pale yellow, calcareous clay loam. Pale yellow and yellowish brown, soft, interbedded shale and sandstone bedrock is at a depth of about 29 inches. In some areas, the depth to bedrock is more than 40 inches or the surface layer is darker and thicker.

Included with this soil in mapping are small areas of Razor, Satanta, and Shingle soils. These soils make up less than 15 percent of any one mapped area. Razor soils are in landscape positions similar to those of the Cushman soil. They have more clay than the Cushman soil. Satanta soils are on foot slopes. They do not have bedrock within a depth of 40 inches. They have a surface layer that is thicker and darker than that of the Cushman soil. Shingle soils are higher on the landscape than the Cushman soil. They are 10 to 20 inches deep over bedrock.

The content of organic matter is moderately low in the Cushman soil. Permeability is moderate. Available

water capacity is low. Runoff is medium. The shrink-swell potential is moderate.

About half of the acreage is used for grazing. Generally, no hazards or limitations affect the use of this soil for rangeland. Water erosion is a management concern if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Water erosion is a hazard. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Controlling water erosion and conserving moisture are important management concerns in cultivated areas. Contour farming, minimizing tillage, and including grasses and legumes in the cropping system help to control water erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The capability unit is IVe-1; Silty range site; windbreak suitability group 6R.

CzD—Cushman-Shingle loams, 9 to 15 percent slopes. These well drained, strongly sloping soils are on dissected plains. The moderately deep Cushman soil is on the lower back slopes. The shallow Shingle soil is on the upper back slopes and convex summits. Areas of this map unit are irregular in shape and are 40 to 350 acres in size. They are 45 to 55 percent Cushman soil and 35 to 45 percent Shingle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Cushman soil is brown loam about 3 inches thick. The subsoil is grayish brown and light yellowish brown, friable clay loam about 13 inches thick. It is calcareous in the lower part. The underlying material is pale yellow, calcareous clay loam. Pale yellow and yellowish brown, soft, interbedded shale and sandstone bedrock is at a depth of about 29 inches. In some areas, the depth to bedrock is more than 40 inches or the surface layer is darker and thicker.

Typically, the surface layer of the Shingle soil is yellow loam about 3 inches thick. The underlying material is yellow, calcareous loam. It contains 20 percent, by volume, fine, soft fragments of shale. Very pale brown and yellow, soft, interbedded sandy shale and sandstone bedrock is at a depth of about 14 inches. In some areas the soil has more clay.

Included with these soils in mapping are small areas of Arvada, Razor, and Satanta soils and Rock outcrop. These included soils and Rock outcrop make up less than 20 percent of any one mapped area. The deep Arvada soils are on foot slopes on terraces. They have a sodium-affected subsoil. Razor soils are in landscape positions similar to those of the Cushman soil. They have more clay than the Cushman soil. Satanta soils are on foot slopes. They have a thick, dark surface layer and do not have bedrock within a depth of 40 inches. The Rock outcrop is on ridges and knolls. It does not support vegetation.

The content of organic matter is moderately low in the Cushman and Shingle soils. Permeability is moderate. Available water capacity is low in the Cushman soil and very low in the Shingle soil. Runoff is medium on both soils. The shrink-swell potential is moderate.

Most of the acreage is used for grazing. These soils are suited to rangeland. Water erosion is an important management concern if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control water erosion.

These soils are generally not suited to cultivated crops or to tame pasture and hay because of the slope. The shallowness to bedrock in the Shingle soil also is a limitation.

The Cushman soil is suited to windbreaks and environmental plantings. The slope is a limitation. Trees and shrubs can be established on the Cushman soil, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion. The Shingle soil generally is unsuited to windbreaks and environmental plantings because of the shallowness to bedrock.

The Cushman soil is in capability unit VIe-1, Silty range site, and windbreak suitability group 6R. The Shingle soil is in capability unit VIe-11, Shallow range site, and windbreak suitability group 10.

DmA—Denby silty clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on foot slopes on terraces. Areas are irregular in shape and are 60 to 300 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is light brownish gray silty clay about 3 inches thick. The subsoil is about 23 inches thick. It is light brownish gray and light gray, very firm and firm clay and clay loam. The underlying material to a depth of 60 inches is light gray, stratified silty clay loam. The soil is calcareous throughout. In

some areas clay or mudstone bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Cedarpass and Interior soils. These soils make up less than 15 percent of any one mapped area. They have less clay than the Denby soil. Cedarpass soils are on the slightly higher parts of the landscape. Interior soils are on the lower parts of the landscape.

The content of organic matter is moderate in the Denby soil. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material. This soil has a high content of sodium that adversely affects the growth of most plants.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. The high content of sodium is a limitation. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soil may become compacted if cultivated when wet. Preventing compaction and conserving moisture are important management concerns in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and subsoiling or deep chiseling help to prevent compaction and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IVs-6; Clayey range site; windbreak suitability group 4C.

Eg—Egas silty clay loam. This deep, poorly drained, nearly level soil is on low flood plains. It is occasionally flooded for brief periods. Areas are irregular in shape and are 20 to 200 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is grayish brown silty clay loam about 5 inches thick. The next 13 inches is grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is light brownish gray silty clay. The soil is calcareous and contains salts throughout. In irrigated areas along Rapid Creek, this soil is somewhat poorly drained.

Included with this soil in mapping are small areas of Arvada, Ottumwa, and Owanka soils. These soils make up less than 10 percent of any one mapped area. Arvada soils are in the slightly higher landscape positions. They have a sodium-affected subsoil. Ottumwa and Owanka soils are on the higher parts of the landscape. They do not have visible salts within a depth of 10 inches. In places, the soil is very poorly drained and the dominant vegetation is cattails and reeds.

The content of organic matter is moderate in the Egas soil. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high. A seasonal high water table is within a depth of 1 foot. This soil has a high content of salts that adversely affects the growth of most plants.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings because of the high content of salts at or near the surface and the high water table. The soil is suited to tame pasture and hay, but a high degree of salinity limits the choice of pasture plants. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants.

The capability unit is VIs-6; Saline Lowland range site; windbreak suitability group 10.

EmA—Emigrant loam, 0 to 2 percent slopes. This moderately deep, well drained, nearly level soil is on back slopes on plains. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is brown and light yellowish brown, friable and firm clay loam about 20 inches thick. It is calcareous in the lower part. The underlying material is light yellowish brown, firm, calcareous clay loam. Brown, soft mudstone and sandstone bedrock is at a depth of about 33 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Beckton soils. These soils make up less than 10 percent of any one mapped area. They are moderately well drained and are on foot slopes on high terraces. They have a sodium-affected subsoil.

The content of organic matter is moderate in the Emigrant soil. Permeability is moderately slow. Available water capacity is low. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland.

Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Droughtiness is a limitation. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture.

This soil is suited to windbreaks and environmental plantings. The droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 6R.

EmB—Emigrant loam, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on back slopes on plains. Areas are irregular in shape and are 80 to 400 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is brown and light yellowish brown, friable and firm clay loam about 20 inches thick. It is calcareous in the lower part. The underlying material is light yellowish brown, firm, calcareous clay loam. Brown, soft mudstone and sandstone bedrock is at a depth of about 33 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Beckton and Norrest soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are on foot slopes on high terraces. Norrest soils are on the higher parts of the landscape. They have a surface layer that is lighter colored than that of the Emigrant soil.

The content of organic matter is moderate in the Emigrant soil. Permeability is moderately slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. It is somewhat droughty. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling wind erosion and water erosion are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, stripcropping, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion and water erosion.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 6R.

EnD—Enning-Minnequa silt loams, 9 to 25 percent slopes. These well drained, strongly sloping and moderately steep soils are on dissected plains. The shallow Enning soil is on the upper back slopes and convex summits. The moderately deep Minnequa soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 20 to 160 acres in size. They are 45 to 55 percent Enning soil and 30 to 40 percent Minnequa soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Enning soil is light brownish gray silt loam about 4 inches thick. The underlying material is very pale brown silt loam. Very pale brown and light gray, soft, chalky shale bedrock is at a depth of about 18 inches. The soil is calcareous throughout.

Typically, the surface layer of the Minnequa soil is grayish brown silt loam about 5 inches thick. The next 12 inches is pale brown, friable silt loam. The underlying material is pale brown silt loam. Light yellowish brown and brownish yellow, interbedded, hard limestone and soft, chalky shale bedrock is at a depth of about 26 inches. The soil is calcareous throughout. In some areas the depth to limestone or shale bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Midway, Nihill, and Savo soils. These included soils make up less than 15 percent of any one mapped area. Midway soils are in landscape positions similar to those of the Enning soil. They have more clay than the Enning soil. Nihill soils are on back slopes on terrace scarps and are less than 20 inches deep to gravelly material. The deep Savo soils are on the upper foot slopes. They have a surface layer that is thicker and darker than that of the Enning and Minnequa soils.

The content of organic matter is moderately low in the Enning soil and low in the Minnequa soil. Permeability is moderate in both soils. Available water capacity is very low in the Enning soil and low in the Minnequa soil. Runoff is rapid on the Enning soil and medium on the Minnequa soil. The shrink-swell

potential is low in the Enning soil and moderate in the Minnequa soil.

All of the acreage is used for grazing. These soils are suited to rangeland. Water erosion is an important management concern if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control water erosion.

These soils generally are not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope. The shallowness to bedrock is a limitation in areas of the Enning soil.

The Enning soil is in capability unit VIe-11 and Shallow range site. The Minnequa soil is in capability unit VIe-3 and Thin Upland range site. Both soils are in windbreak suitability group 10.

FaE—Fairburn clay loam, 9 to 40 percent slopes. This shallow, well drained, strongly sloping to steep soil is on back slopes on dissected plains. Areas are irregular in shape and are 100 to 600 acres in size. Slopes are convex.

Typically, the surface layer is brown clay loam about 4 inches thick. The next 6 inches is grayish brown, friable clay loam. The underlying material is light brownish gray clay loam. Light gray, soft, interbedded, very fine grained sandstone and shale bedrock is at a depth of about 15 inches. The soil is calcareous throughout. In some areas the depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are small areas of Blackpipe, Midway, and Norrest soils and Badland. These included soils and Badland make up less than 15 percent of any one mapped area. The moderately deep Blackpipe and Norrest soils are on back slopes. Midway soils are in landscape positions similar to those of the Fairburn soil. They have more clay than the Fairburn soil. The Badland is on escarpments, mudstone exposures, and spires. It does not support vegetation.

The content of organic matter is moderately low in the Fairburn soil. Permeability is moderate. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is moderate.

Most of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is an important management concern if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and help to control water erosion. Sites for stock water impoundments are plentiful, but seepage can be a problem.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the shallowness to bedrock and the slope.

The capability unit is VIe-11; Thin Upland range site; windbreak suitability group 10.

FgE—Fairburn gravelly clay loam, 15 to 45 percent slopes, bouldery. This shallow, well drained, moderately steep to steep soil is on back slopes on dissected plains. Sandstone slabs that are 3 to 10 feet in diameter and 9 to 30 inches thick are scattered throughout the map unit. Areas are irregular in shape and are 40 to 480 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown, gravelly clay loam about 4 inches thick. The next 4 inches is grayish brown clay loam. The underlying material is pale brown clay loam. Very pale brown, soft shale bedrock is at a depth of about 14 inches. The soil is calcareous throughout. In some areas bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Grummit, Midway, and Razor soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Grummit and Midway soils are in landscape positions similar to those of the Fairburn soil. The clayey Grummit soils are acid. Midway soils have more clay than the Fairburn soil. Razor soils are on back slopes. They are 20 to 40 inches deep over shale bedrock. The Rock outcrop occurs as ledges of sandstone and conglomerate. It does not support vegetation.

The content of organic matter is moderately low in the Fairburn soil. Permeability is moderate. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is moderate.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is a problem if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control water erosion. Sites for stock water impoundments are plentiful, but seepage can be a problem.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the shallowness to bedrock, the slope, and the scattered boulders.

The capability unit is VIIs-6; Thin Upland range site; windbreak suitability group 10.

FhE—Fairburn-Badland complex, 9 to 40 percent slopes. This map unit consists of a shallow, well drained, strongly sloping to steep Fairburn soil and areas of Badland. It is on dissected plains. The Fairburn soil is on vegetated back slopes and ridges. The Badland is in steep, barren areas on escarpments, mounds, and pinnacles. Areas of this map unit are irregular in shape and are 150 to 350 acres in size. They are 50 to 60 percent Fairburn soil and 30 to 40 percent Badland. The Fairburn soil and Badland occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Fairburn soil is brown clay loam about 4 inches thick. The next 6 inches is grayish brown, friable clay loam. The underlying material is light brownish gray clay loam. Light gray, soft, interbedded, very fine grained sandstone and shale bedrock is at a depth of about 15 inches. The soil is calcareous throughout. In some areas the depth to bedrock is 20 to 40 inches.

The Badland consists of exposures of the Brule, Chadron, and Pierre Formations. It supports little or no vegetation.

Included in this unit in mapping are small areas of Cedarpass, Denby, Norrest, and Orella soils. These soils make up less than 20 percent of any one mapped area. Cedarpass and Denby soils are on foot slopes on terraces. They are more than 40 inches deep over bedrock. Norrest soils are on the lower back slopes. They are 20 to 40 inches deep over bedrock. Norrest and Orella soils have more clay than the Fairburn soil. Orella soils are in landscape positions similar to those of the Fairburn soil.

The content of organic matter is moderately low in the Fairburn soil. Permeability is moderate. Available water capacity is very low. Runoff is rapid on the Fairburn soil and very rapid on the Badland. The shrink-swell potential is moderate.

All of the acreage is used for grazing. The Fairburn soil is suited to rangeland. The Badland does not support vegetation. Water erosion is a problem in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control water erosion. Sites for stock water impoundments are plentiful, but seepage can be a problem.

This map unit is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope, the shallowness to bedrock, and the Badland.

The Fairburn soil is in capability unit VIe-11 and Thin Upland range site. The Badland is in capability unit VIIIs-1 and is not assigned a range site. The Fairburn soil and the Badland are both in windbreak suitability group 10.

FoF—Fairburn-Orella-Badland complex, 15 to 45 percent slopes. This map unit consists of shallow, well drained, moderately steep to steep soils and areas of Badland. It is on dissected plains. The Fairburn and Orella soils are on the steep and moderately steep, vegetated, upper back slopes. The Fairburn soil is generally higher on the landscape than the Orella soil. The Badland is on steep, barren escarpments. Areas of this map unit are irregular in shape and are 100 to 300 acres in size. They are 40 to 50 percent Fairburn soil, 20 to 30 percent Orella soil, and 15 to 25 percent Badland. The two soils and Badland occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Fairburn soil is brown clay loam about 4 inches thick. The next 6 inches is grayish brown, friable clay loam. The underlying material is light brownish gray clay loam. Light gray, soft, interbedded, very fine grained sandstone and shale bedrock is at a depth of about 15 inches. The soil is calcareous throughout. In some areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Orella soil is light brownish gray clay about 3 inches thick. The next 5 inches is light gray, firm clay. It contains 15 percent, by volume, soft fragments of mudstone. The underlying material is light gray clay. It contains 45 percent, by volume, soft fragments of mudstone. White and pale yellow, soft mudstone bedrock is at a depth of about 14 inches. The soil is calcareous throughout.

The Badland consists of exposures of the Brule, Chadron, and Pierre Formations. It is on mounds, pinnacles, and escarpments. It supports little or no vegetation.

Included in this unit in mapping are small areas of Cedarpass and Norrest soils. These soils make up less than 15 percent of any one mapped area. Cedarpass soils are on summits. They do not have shale or mudstone bedrock within a depth of 40 inches. Norrest soils are on the lower back slopes. They have shale or mudstone bedrock at a depth of 20 to 40 inches.

The content of organic matter is moderately low in the Fairburn soil and low in the Orella soil. Permeability is moderate in the Fairburn soil and very slow in the Orella soil. Available water capacity is very low in both soils. Runoff is rapid on the Fairburn and Orella soils and very rapid on the Badland. The shrink-swell potential is moderate in the Fairburn soil and high in the Orella soil. The Orella soil has a content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. The Fairburn and Orella soils are suited to rangeland. The Badland does not support vegetation. Water erosion is a problem if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control water erosion. Sites for stock water impoundments are plentiful, but seepage can be a problem in areas of the Fairburn soil.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope, the shallowness to bedrock, and the Badland.

The Fairburn and Orella soils are in capability unit VIIe-5. The Fairburn soil is in Thin Upland range site, and the Orella soil is in Shallow Clay range site. The Badland is in capability unit VIIIs-1 and is not assigned a range site. The Fairburn and Orella soils and the Badland are in windbreak suitability group 10.

Gb—Glenberg fine sandy loam. This deep, well drained, level soil is on high flood plains. In most areas it is subject to rare flooding for very brief periods, but in some areas it is frequently flooded. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are smooth.

Typically, the surface layer is light brownish gray, calcareous fine sandy loam about 4 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous fine sandy loam that has thin layers of sandy loam. In some areas the soil has more clay throughout.

Included with this soil in mapping are small areas of Bankard and Lohmiller soils. These soils make up less than 10 percent of any one mapped area. Bankard soils are closer to the stream channels than the Glenberg soil and have more coarse sand. Lohmiller soils are in the lower landscape positions. They have more clay throughout than the Glenberg soil.

The content of organic matter is low in the Glenberg soil. Permeability is moderately rapid. Available water capacity is low. Runoff is slow.

About half of the acreage is used for grazing. Generally, no hazards or limitations affect the use of this soil for rangeland. Wind erosion is a problem in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to control wind erosion and maintain maximum forage production. In some low areas trees and shrubs provide protection for livestock and wildlife.

Most of the cultivated acreage is irrigated. This soil is suited to cultivated crops and to tame pasture and hay. A high content of lime in the surface layer adversely affects the availability of plant nutrients. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling wind erosion are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control wind erosion. In some years floodwater delays planting, but in most years the additional moisture is beneficial and flood damage is minor.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IVe-6; Loamy Overflow range site; windbreak suitability group 1.

GrE—Grummit-Rock outcrop complex, 6 to 40 percent slopes. This map unit consists of a shallow, well drained, moderately sloping to steep Grummit soil and areas of Rock outcrop. It is on dissected plains. The Grummit soil is on vegetated shoulder slopes and back slopes. The Rock outcrop occurs in a random pattern throughout the map unit. Areas of this map unit are irregular in shape and are 80 to 400 acres in size. They are 50 to 60 percent Grummit soil and 25 to 35 percent Rock outcrop. The Grummit soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Grummit soil is gray clay about 3 inches thick. The underlying material also is gray clay. It contains 25 percent, by volume, soft fragments of shale. Gray, platy, soft, acid shale bedrock is at a depth of about 12 inches.

The Rock outcrop is gray, acid shale. It generally does not support vegetation.

Included in this unit in mapping are small areas of Fairburn, Kyle, and Pierre soils. These soils make up less than 15 percent of any one mapped area. Fairburn soils are in landscape positions similar to those of the Grummit soil. They have less clay throughout than the Grummit soil. Kyle and Pierre soils are on the lower parts of the landscape. They are more than 20 inches deep over shale bedrock.

The content of organic matter is moderately low in the Grummit soil. Permeability is moderately slow. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is high.

All of the acreage is used for grazing. The Grummit soil is suited to rangeland. Water erosion is a problem if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking

rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control water erosion. Sites for stock water impoundments are plentiful.

This map unit is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the shallowness to bedrock, the slope, and the Rock outcrop. Some areas of the Rock outcrop, however, support sparse stands of stunted ponderosa pine.

The Grummit soil is in capability unit VIIe-5 and Shallow Clay range site. The Rock outcrop is in capability unit VIIIs-2 and is not assigned a range site. The Grummit soil and the Rock outcrop are both in windbreak suitability group 10.

GsD—Grummit-Urban land complex, 9 to 30 percent slopes. This map unit consists of a shallow, well drained, strongly sloping to steep Grummit soil and areas of Urban land. It is on uplands. The Grummit soil is on shoulder slopes and back slopes on dissected plains. Areas of this map unit are irregular in shape and are 40 to 350 acres in size. They are 55 to 65 percent Grummit soil and 25 to 35 percent Urban land. The Grummit soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not possible.

Typically, the surface layer of the Grummit soil is gray clay about 3 inches thick. The underlying material also is gray clay. It contains 25 percent, by volume, soft fragments of shale. Gray, platy, soft, acid shale bedrock is at a depth of about 12 inches.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are residential and consist of single family houses and apartments. Some areas are commercial or industrial sites.

Included in this unit in mapping are small areas of Nihill and Pierre soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Nihill soils are on terrace scarps. They are gravelly throughout. Pierre soils are on the lower parts of the landscape. They have shale bedrock at a depth of 20 to 40 inches. The Rock outcrop is on ridges and knolls. It does not support vegetation.

The content of organic matter is moderately low in the Grummit soil. Permeability is moderately slow. Available water capacity is very low. Runoff is medium on the Grummit soil and very rapid on the Urban land. The shrink-swell potential is high.

The Grummit soil is poorly suited to lawns and gardens because of the shallowness to bedrock and the slope. Additions of topsoil may be needed to overcome the shallow rooting depth.

The Grummit soil is poorly suited to building site development and sanitary facilities because of the shallowness to bedrock, the high shrink-swell potential, and the slope. Reinforcing foundations and footings, backfilling with sandy material, installing foundation drains, and diverting runoff away from the buildings help to prevent structural damage caused by shrinking and swelling. The base material for streets and roads needs to be strengthened to support vehicular traffic. Underground utilities require protection from the highly corrosive, acid shale.

No interpretive groups are assigned to this unit.

Ha—Haverson silt loam. This deep, well drained, level soil is on high flood plains. It is subject to rare flooding for very brief periods. Areas are irregular in shape and are 20 to 200 acres in size. Slopes are smooth.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The underlying material to a depth of 60 inches is pale brown very fine sandy loam, grayish brown silty clay loam, and light brownish gray sandy loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Bankard, Bridgeport, Glenberg, and Lohmiller soils. These soils make up less than 10 percent of any one mapped area. They are in landscape positions similar to those of the Haverson soil. Bankard and Glenberg soils have less clay and more sand than the Haverson soil. Bridgeport soils have a surface layer that is thicker and darker than that of the Haverson soil. Lohmiller soils have more clay than the Haverson soil.

The content of organic matter is moderately low in the Haverson soil. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture. In some years floodwater may delay planting, but in most years the additional moisture is beneficial and flood damage is minor.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 1.

Hc—Haverson loam, channeled. This deep, well drained, nearly level soil is on low flood plains that are dissected into small tracts by narrow stream channels. It is occasionally flooded for brief periods. Areas are long and narrow and are 40 to 200 acres in size. Slopes are smooth.

Typically, the surface layer is brown loam about 6 inches thick. The underlying material to a depth of 60 inches is grayish brown and brown, stratified clay loam and sandy loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Bankard, Bridgeport, Glenberg, and Lohmiller soils. These soils make up less than 10 percent of any one mapped area. They are in landscape positions similar to those of the Haverson soil. Bankard and Glenberg soils have less clay and more sand than the Haverson soil. Bridgeport soils have a surface layer that is thicker and darker than that of the Haverson soil. Lohmiller soils have more clay than the Haverson soil.

The content of organic matter is moderately low in the Haverson soil. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Green ash, American elm, cottonwood, chokecherry, buffaloberry, and willow grow adjacent to the stream channels in many areas.

This soil is generally unsuited to cultivated crops because it is dissected into small tracts and is subject to spring flooding. It is suited to tame pasture and hay, but harvesting is difficult because of the channeled landscape. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Because the meandering stream channels can hinder planting by machine, hand planting may be needed.

The capability unit is VIw-1; Loamy Overflow range site; windbreak suitability group 1.

HpB—Hisle silt loam, 0 to 6 percent slopes. This moderately deep, well drained, nearly level to gently sloping, sodium-affected soil is on the lower back slopes on plains. Areas are irregular in shape and are 15 to 200 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is grayish brown silt loam about 2 inches thick. The subsoil is brown and pale brown, very firm, calcareous silty clay about 19 inches thick. It has accumulations of salts and carbonate in the lower part. The underlying material is pale brown, calcareous silty clay. Light gray, calcareous, soft shale bedrock is at a depth of about 28 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Conata, Kyle, Larvie, Ottumwa, and Pierre soils and Slickspots. These included soils and Slickspots make up less than 10 percent of any one mapped area. These soils are slightly higher on the landscape than the Hisle soil. They do not have a sodium-affected subsoil. The Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderately low in the Hisle soil. Permeability is very slow. Available water capacity is very low. Runoff is slow. The shrink-swell potential is very high. This soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is generally unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense, sodium-affected subsoil and a high content of salts in the subsoil are limitations.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

HrC—Hisle-Rock outcrop complex, 2 to 9 percent slopes. This map unit consists of a moderately deep, well drained, gently sloping and moderately sloping, sodium-affected Hisle soil and areas of Rock outcrop. It is on the lower back slopes on plains. The Hisle soil is in vegetated areas. The Rock outcrop is barren or very sparsely vegetated. Areas of this map unit are irregular in shape and are 10 to 150 acres in size. They are 40 to 50 percent Hisle soil and 35 to 45 percent Rock outcrop. The Hisle soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 2 inches thick. The subsoil is brown and pale brown, very firm, calcareous silty clay about 19 inches thick. It has accumulations of salts and carbonate in the lower part. The underlying material is pale brown, calcareous silty clay. Light gray, calcareous, soft shale bedrock is at a depth of about 28

inches. In some areas the depth to bedrock is more than 40 inches.

The Rock outcrop is multicolored shale that has a thin layer of gravel on the surface. It generally does not support vegetation.

Included in this unit in mapping are small areas of Conata, Larvie, Pierre, and Samsil soils and Slickspots. These included soils and Slickspots make up less than 20 percent of any one mapped area. These soils are slightly higher on the landscape than the Hisle soil. They do not have a sodium-affected subsoil. The Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderately low in the Hisle soil. Permeability is very slow. Available water capacity is very low. Runoff is medium on the Hisle soil and rapid in areas of the Rock outcrop. The shrink-swell potential is very high in the Hisle soil. The Hisle soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. The Hisle soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This map unit is generally unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense, sodium-affected subsoil in the Hisle soil and the Rock outcrop are limitations.

The Hisle soil is in capability unit VIs-3 and Thin Claypan range site. The Rock outcrop is in capability unit VIIIs-2 and is not assigned a range site. The Hisle soil and the Rock outcrop are both in windbreak suitability group 10.

HsB—Hisle-Slickspots complex, 0 to 6 percent slopes. This map unit consists of a moderately deep, well drained, nearly level to gently sloping, sodium-affected Hisle soil and areas of Slickspots. It is on plains. The Hisle soil is on vegetated back slopes. The Slickspots are on the lower back slopes in slightly depressed areas. Areas of this map unit are irregular in shape and are 50 to 200 acres in size. They are 65 to 75 percent Hisle soil and 15 to 25 percent Slickspots. The Hisle soil and Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 2 inches thick. The subsoil is brown and pale brown, very firm, calcareous silty clay about 19 inches thick. It has accumulations of salts and carbonate in the lower part. The underlying material is pale brown, calcareous silty clay. Light gray, calcareous, soft shale bedrock is at a depth of about 28 inches. In some areas the depth to bedrock is more than 40 inches.

The Slickspots have a surface layer of dense, massive clay. Visible salts are at or near the surface. The underlying material is very firm, calcareous clay. Shale bedrock is at a depth of about 25 inches. The Slickspots generally do not support vegetation.

Included in this unit in mapping are small areas of Kyle, Larvie, Ottumwa, and Pierre soils. These soils make up less than 15 percent of any one mapped area. They are slightly higher on the landscape than the Hisle soil. They do not have a sodium-affected subsoil.

The content of organic matter is moderately low in the Hisle soil. Permeability is very slow. Available water capacity is very low. Runoff is slow or medium. The shrink-swell potential is very high in the Hisle soil. The Hisle soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. The Hisle soil is suited to rangeland. The Slickspots do not support grazable vegetation. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense, sodium-affected subsoil in the Hisle soil and the Slickspots are limitations.

The Hisle soil is in capability unit VIs-3 and Thin Claypan range site. The Slickspots are in capability unit VIIIs-3 and are not assigned a range site. The Hisle soil and the Slickspots are both in windbreak suitability group 10.

Hv—Hoven silt loam. This deep, poorly drained, sodium-affected, level soil is in closed depressions on plains. It is ponded during periods of snowmelt and heavy rainfall. Areas are circular and are 15 to 100 acres in size.

Typically, the surface layer is light brownish gray silt loam about 6 inches thick. The subsoil is grayish brown and brown, very firm clay about 28 inches thick. It has accumulations of carbonate in the lower part. The underlying material is pale brown and very pale brown, calcareous silty clay loam. Multicolored, soft, interbedded sandstone and soft shale bedrock is at a depth of about 52 inches. In some areas the subsoil is not sodium affected.

Included with this soil in mapping are small areas of Blackpipe, Nunn, Satanta, and Wortman soils. These soils make up less than 15 percent of any one mapped

area. They are near the outer edges of the mapped areas. The well drained Blackpipe, Nunn, and Satanta soils do not have a sodium-affected subsoil. Wortman soils are well drained and have bedrock at a depth of 20 to 40 inches.

The content of organic matter is moderate in the Hoven soil. Permeability is very slow. Available water capacity is moderate. Runoff is ponded. Water ponds on this soil during wet periods. The shrink-swell potential is high. A seasonal high water table is within a depth of 1.5 feet.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings because of the ponding and the sodium-affected subsoil. It is suited to tame pasture and hay. Garrison creeping foxtail and western wheatgrass are examples of suitable pasture plants.

The capability unit is VIs-3; Closed Depression range site; windbreak suitability group 10.

Hz—Hoven Variant silty clay, ponded. This deep, very poorly drained, level soil is in closed depressions on plains. It is ponded for more than 50 percent of the growing season. Areas are circular and are 15 to 80 acres in size.

Typically, the surface layer is dark gray silty clay about 5 inches thick. The subsoil is dark gray and gray, firm clay. It has accumulations of salts in the lower part. The underlying material is grayish brown, calcareous clay. Light gray, calcareous, soft, interbedded sandstone and shale bedrock is at a depth of about 50 inches.

Included with this soil in mapping are small areas of Blackpipe, Satanta, Wanblee, and Wortman soils. These soils make up less than 15 percent of any one mapped area. They are along the outer edges of the mapped areas. The well drained Blackpipe and Satanta soils have less clay than the Hoven Variant soil. The well drained Wanblee and Wortman soils have a sodium-affected subsoil.

The content of organic matter is moderate in the Hoven Variant soil. Permeability is very slow. Available water capacity is low. Runoff is ponded. Water ponds on this soil during the growing season, and areas are dry only in late summer and during droughts. As much as 2 feet of ponded water is on the surface during wet periods. The shrink-swell potential is very high. A seasonal high water table is within a depth of 4 feet.

Bare areas are common, but some areas support a sparse stand of rushes and sedges. This soil provides habitat for wetland wildlife. Many areas are potential sites for excavated ponds.

This soil is generally unsuited to rangeland, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the ponding.

The capability unit is VIIIw-1; windbreak suitability group 10. No range site is assigned.

In—Interior loam. This deep, well drained, nearly level, sodium-rich soil is on high flood plains and foot slopes on alluvial fans. It is subject to rare flooding for very brief periods. Areas are irregular in shape and are 40 to 150 acres in size. Slopes are smooth.

Typically, the surface layer is light gray loam about 2 inches thick. The underlying material to a depth of 60 inches is white and light gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas the surface layer is silty clay.

Included with this soil in mapping are small areas of Cedarpass, Denby, Orella, and Whitewater soils. These soils make up less than 10 percent of any one mapped area. Cedarpass soils are slightly higher on the landscape than the Interior soil. They have a surface layer that is darker than that of the Interior soil and are less stratified. Denby soils are in landscape positions similar to those of the Interior soil. Orella and Whitewater soils are slightly higher on the landscape than the Interior soil. Denby, Orella, and Whitewater soils have more clay than the Interior soil.

The content of organic matter is low in the Interior soil. Permeability is moderately slow. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate. This soil has a high content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. Generally, no hazards or limitations affect the use of this soil for rangeland. Wind erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control wind erosion.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The high content of sodium and the flooding are limitations.

The capability unit is VIs-7; Thin Upland range site; windbreak suitability group 10.

Io—Interior loam, channeled. This deep, well drained, nearly level soil is on low flood plains that are dissected into small tracts by narrow stream channels. It is frequently flooded for brief periods. Areas are long

and narrow and are 20 to 150 acres in size. Slopes are smooth.

Typically, the surface layer is light gray loam about 2 inches thick. The underlying material to a depth of 60 inches is white and light gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas the surface layer is silty clay.

Included with this soil in mapping are small areas of Cedarpass and Denby soils. These soils make up less than 10 percent of any one mapped area. They are slightly higher on the landscape than the Interior soil. Cedarpass soils have a surface layer that is darker than that of the Interior soil. Denby soils have more clay than the Interior soil.

The content of organic matter is low in the Interior soil. Permeability is moderately slow. Available water capacity is high. Runoff is slow. This soil has a high content of sodium that adversely affects the growth of most plants.

Most areas of this soil support native grasses and are used for grazing. This soil is suited to rangeland. Wind erosion is a hazard if the rangeland is overgrazed. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control wind erosion. Water that pools in some channel areas provides temporary watering sites for livestock and wildlife.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The high content of sodium throughout the soil and the deep meandering stream channels are limitations.

The capability unit is VIw-1; Badland Overflow range site; windbreak suitability group 10.

IrB—Interior-Cedarpass-Denby complex, 0 to 6 percent slopes. These deep, well drained, nearly level and gently sloping, sodium-rich soils are on flood plains and terraces that are dissected by many drainageways. The Interior soil is on high flood plains. It is frequently flooded for brief periods. The Cedarpass and Denby soils are on level summits on mesas and plateaus that are slightly higher on the landscape than the Interior soil. Areas of this map unit are irregular in shape and are 40 to 300 acres in size. They are 30 to 40 percent Interior soil, 20 to 30 percent Cedarpass soil, and 20 to 30 percent Denby soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Interior soil is light gray loam about 2 inches thick. The underlying material to a depth of 60 inches is white and light gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas the surface layer is silty clay.

Typically, the surface layer of the Cedarpass soil is grayish brown silty clay loam about 5 inches thick. The subsoil is light brownish gray and light gray, friable silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches is white and light brownish gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas clay or soft mudstone bedrock is at a depth of 40 to 60 inches.

Typically, the surface layer of the Denby soil is light brownish gray silty clay about 3 inches thick. The subsoil is about 23 inches thick. It is light brownish gray and light gray, very firm and firm clay and clay loam. The underlying material to a depth of 60 inches is light gray, stratified silty clay loam. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Orella and Whitewater soils and Badland. These included soils and Badland make up less than 20 percent of any one mapped area. Orella and Whitewater soils are on the slightly higher parts of the landscape. They have bedrock within a depth of 40 inches. The Badland consists of mudstone outcrops. It is on escarpments and small spires. It does not support vegetation.

The content of organic matter is low in the Interior soil and moderately low in the Cedarpass and Denby soils. Permeability is moderately slow in the Interior soil, moderate in the Cedarpass soil, and slow in the Denby soil. Available water capacity is high in the Interior and Cedarpass soils and moderate in the Denby soil. Runoff is slow on all three soils. The shrink-swell potential is low in the Interior soil and moderate in the Cedarpass soil. It is high in the subsoil of the Denby soil and moderate in the underlying material. These soils have a high content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. No major hazards or limitations affect the use of these soils for rangeland. Compaction in areas of the Denby soil and wind erosion in overgrazed areas are important management concerns. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control wind erosion.

These soils are generally unsuited to cultivated crops because the vertical banks along the drainageways make many areas inaccessible to farm machinery. In areas where seedbed preparation is possible, the Cedarpass and Denby soils are suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. The Interior soil is generally unsuited to tame pasture and hay. Frequent flooding is a limitation.

The Denby and Cedarpass soils are suited to

windbreaks and environmental plantings. The high content of sodium in the subsoil and inaccessibility are limitations. Trees and shrubs can be established on the Denby and Cedarpass soils, but optimum survival, growth, and vigor are unlikely. No trees or shrubs grow well on the Interior soil.

The Interior soil is in capability unit is VIs-7, Badland Overflow range site, and windbreak suitability group 10. The Cedarpass soil is in capability unit IVe-10, Silty range site, and windbreak suitability group 8. The Denby soil is in capability unit IVs-6, Clayey range site, and windbreak suitability group 4C.

JaA—Jayem fine sandy loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on back slopes on plains. Areas are irregular in shape and are 80 to 250 acres in size. Slopes are smooth.

Typically, the surface layer is grayish brown fine sandy loam about 7 inches thick. The subsurface layer is brown fine sandy loam about 11 inches thick. The subsoil is pale brown, very friable fine sandy loam about 17 inches thick. The underlying material to a depth of 60 inches is light yellowish brown loamy fine sand.

Included with this soil in mapping are small areas of Satanta, Valent, and Whitelake soils. These soils make up less than 10 percent of any one mapped area. Satanta soils are in landscape positions similar to those of the Jayem soil. They have more clay in the subsoil than the Jayem soil. Valent soils are on the slightly higher parts of the landscape. They have more sand than the Jayem soil. Whitelake soils are in depressions. They have a sodium-affected subsoil.

The content of organic matter is moderately low in the Jayem soil. Permeability is moderately rapid. Available water capacity is moderate. Runoff is slow.

About half of the acreage is used for grazing. Generally, no hazards or limitations affect the use of this soil for rangeland. Wind erosion is a management concern in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control wind erosion.

This soil is suited to cultivated crops and to tame pasture and hay. It is somewhat droughty. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Controlling wind erosion and conserving moisture are important management concerns in cultivated areas. Minimizing tillage, including grasses and legumes in the cropping system, establishing field windbreaks, and leaving crop residue on the surface help to control wind erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. All climatically suited trees and shrubs grow well. Fallowing the site prior to spring planting helps to establish new trees and shrubs.

The capability unit is IIIe-4; Sandy range site; windbreak suitability group 5.

JaC—Jayem fine sandy loam, 3 to 9 percent slopes. This deep, well drained, gently sloping to moderately sloping soil is on back slopes on dissected plains. Areas are irregular in shape and are 40 to 350 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown fine sandy loam about 7 inches thick. The subsurface layer is brown fine sandy loam about 11 inches thick. The subsoil is pale brown, very friable fine sandy loam about 17 inches thick. The underlying material to a depth of 60 inches is light yellowish brown loamy fine sand.

Included with this soil in mapping are small areas of Satanta, Valent, and Whitelake soils. These soils make up less than 15 percent of any one mapped area. Satanta soils are in landscape positions similar to those of the Jayem soil. They have more clay in the subsoil than the Jayem soil. Valent soils are slightly higher on the landscape than the Jayem soil. They have more sand than the Jayem soil. Whitelake soils are in depressions. They have a sodium-affected subsoil.

The content of organic matter is moderately low in the Jayem soil. Permeability is moderately rapid. Available water capacity is moderate. Runoff is slow.

Most of the acreage is used for grazing or hay. Generally, no hazards or limitations affect the use of this soil for rangeland. Wind erosion is a management concern in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control wind erosion.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are suitable pasture plants. Controlling wind erosion and conserving moisture are important management concerns in cultivated areas. Leaving crop residue on the surface, establishing field windbreaks, minimizing tillage, and including grasses and legumes in the cropping system help to control wind erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. All climatically suited trees and shrubs grow well. Fallowing the site prior to spring planting helps to establish new trees and shrubs.

The capability unit is IVe-6; Sandy range site; windbreak suitability group 5.

KtA—Kyle clay, 0 to 1 percent slopes. This deep, well drained, level soil is on foot slopes on alluvial fans. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 80 to 200 acres in size. Slopes are plane and smooth.

Typically, the surface layer is dark gray clay about 4 inches thick. The subsoil is dark gray, very firm, calcareous clay about 14 inches thick. The underlying material to a depth of 60 inches is dark grayish brown, very firm, calcareous clay. In some areas shale bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Hisle, Larvie, and Whitewater soils. These soils make up less than 10 percent of any one mapped area. Hisle soils are in slightly concave areas and have a sodium-affected subsoil. Larvie and Whitewater soils are in the slightly higher landscape positions. They have mudstone bedrock at a depth of 20 to 40 inches and a light colored surface layer.

The content of organic matter is moderate in the Kyle soil. Permeability is very slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Preventing compaction and conserving moisture are important management concerns in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and subsoiling or deep chiseling help to prevent compaction and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IVs-3; Clayey range site; windbreak suitability group 4C.

KyA—Kyle clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on foot slopes on alluvial fans. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 80 to 200 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown clay about 4 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 21 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. It has accumulations of salts. In some areas the depth to shale is less than 40 inches.

Included with this soil in mapping are small areas of Hisle, Lohmiller, and Swanboy soils. These soils make up less than 10 percent of any one mapped area. Hisle soils are slightly lower on the landscape than the Kyle soil. They have a sodium-affected subsoil. The stratified Lohmiller soils are on high flood plains. Swanboy soils are in landscape positions similar to those of the Kyle soil. They have visible salts within a depth of 10 inches.

The content of organic matter is moderate in the Kyle soil. Permeability is very slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is very high.

About half of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Preventing compaction and conserving moisture are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to prevent compaction and conserve moisture.

This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IVs-3; Clayey range site; windbreak suitability group 4C.

KyB—Kyle clay, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on foot slopes on alluvial fans. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 40 to 400 acres in size. Slopes are smooth or convex.

Typically, the surface layer is dark grayish brown clay about 4 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 21 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. It has accumulations of

salts. In some areas, the depth to shale is less than 40 inches or the surface layer is thicker and darker.

Included with this soil in mapping are small areas of Hisle, Ottumwa, and Swanboy soils. These soils make up less than 15 percent of any one mapped area. Hisle soils are slightly lower on the landscape than the Kyle soil. They have a sodium-affected subsoil. Ottumwa soils are in the slightly higher landscape positions. They have a surface layer that is thicker and darker than that of the Kyle soil and have less clay throughout. Swanboy soils are in landscape positions similar to those of the Kyle soil. They have visible salts within a depth of 10 inches.

The content of organic matter is moderate in the Kyle soil. Permeability is very slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

About half of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, western wheatgrass, and crested wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Water erosion, compaction, and moisture conservation are important management concerns in cultivated areas. Contour farming, subsoiling or deep chiseling, and leaving crop residue on the surface help to control water erosion, prevent compaction, and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

KyC—Kyle clay, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on foot slopes on alluvial fans. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown clay about 4 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 21 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. It has accumulations of salts. In some areas shale bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Hisle and Swanboy soils. These soils make up less than 15 percent of any one mapped area. Hisle soils are slightly lower on the landscape than the Kyle soil. They have a sodium-affected subsoil. Swanboy soils are in landscape positions similar to those of the Kyle soil. They have visible salts within a depth of 10 inches.

The content of organic matter is moderate in the Kyle soil. Permeability is very slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Water erosion is a hazard if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are suitable pasture plants. The soil becomes compacted if farmed when wet. Water erosion, compaction, and moisture conservation are important management concerns in cultivated areas. Contour farming, subsoiling or deep chiseling, and leaving crop residue on the surface help to control water erosion, prevent compaction, and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-14; Clayey range site; windbreak suitability group 4C.

LaB—Larvie clay, 0 to 4 percent slopes. This moderately deep, well drained, very gently sloping soil is on back slopes on plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 20 to 250 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is brown clay about 3 inches thick. The subsoil is reddish gray and weak red, very firm clay about 17 inches thick. It has accumulations of carbonate in the lower part. The underlying material is weak red clay. It contains 25 percent, by volume, soft fragments of shale. Weak red,

soft shale bedrock is at a depth of about 29 inches. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Conata, Hisle, and Kyle soils. These soils make up less than 10 percent of any one mapped area. Conata soils are on the slightly higher parts of the landscape. They have bedrock within a depth of 20 inches. Hisle and Kyle soils are slightly lower on the landscape than the Larvie soil. Hisle soils have a sodium-affected subsoil. Kyle soils do not have bedrock within a depth of 40 inches.

The content of organic matter is moderate in the Larvie soil. Permeability is very slow. Available water capacity is very low. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Compaction and moisture conservation are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to prevent compaction and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IVs-3; Clayey range site; windbreak suitability group 4C.

LaD—Larvie clay, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping and strongly sloping soil is on back slopes on dissected plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 40 to 200 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is brown clay about 3 inches thick. The subsoil is reddish gray and weak red, very firm clay about 17 inches thick. It has accumulations of carbonate in the lower part. The underlying material is weak red clay. It contains 25 percent, by volume, soft fragments of shale. Weak red, soft shale bedrock is at a depth of about 29 inches. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Hisle, Kyle, and Orella soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Hisle soils are on the lower parts of the landscape. They have a sodium-affected subsoil. Kyle soils are on foot slopes. They do not have bedrock within a depth of 40 inches. Orella soils are slightly higher on the landscape than the Larvie soil. They have bedrock within a depth of 20 inches. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support grazable vegetation.

The content of organic matter is moderate in the Larvie soil. Permeability is very slow. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Water erosion is a hazard if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock patterns helps to keep gullies from forming. Sites for stock water impoundments are available in some areas.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. The slope is the main limitation. The soil is suited to tame pasture and hay. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Intermediate wheatgrass and western wheatgrass are examples of suitable pasture plants.

The capability unit is VIe-4; Clayey range site; windbreak suitability group 10.

LhC—Larvie-Hisle complex, 0 to 9 percent slopes. These moderately deep, well drained, nearly level to moderately sloping soils are on dissected plains. The surface is uneven because of microrelief. The Larvie soil is on the upper back slopes and ridges. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. The sodium-affected Hisle soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 20 to 150 acres in size. They are 45 to 55 percent Larvie soil and 30 to 40 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Larvie soil is brown clay about 3 inches thick. The subsoil is reddish gray and weak red, very firm clay about 17 inches thick. It has accumulations of carbonate in the lower part. The underlying material is weak red clay. It contains 25 percent, by volume, soft fragments of shale. Weak red,

soft shale bedrock is at a depth of about 29 inches. The soil is calcareous throughout.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 2 inches thick. The subsoil is brown and pale brown, very firm, calcareous silty clay about 19 inches thick. It is has accumulations of salts and carbonate in the lower part. The underlying material is pale brown, calcareous silty clay. Light gray, calcareous, soft shale bedrock is at a depth of about 28 inches. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Conata and Kyle soils and Slickspots. These included soils and Slickspots make up less than 15 percent of any one mapped area. Conata soils are on shoulder slopes and convex summits. They have bedrock within a depth of 20 inches. Kyle soils are in landscape positions similar to those of the Larvie soil. They do not have bedrock within a depth of 40 inches. Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderate in the Larvie soil and moderately low in the Hisle soil. Permeability is very slow in both soils. Available water capacity is very low. Runoff is medium. The shrink-swell potential is very high. The Hisle soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

The Larvie soil is suited to cultivated crops and to tame pasture and hay, and the Hisle soil is generally unsuited. The dense, sodium-affected subsoil of the Hisle soil restricts root penetration. Intermediate wheatgrass and western wheatgrass are examples of suitable pasture plants. The soils become compacted if farmed when wet. Water erosion and compaction are important management concerns in cultivated areas. Contour farming, leaving crop residue on the surface, and subsoiling or deep chiseling help to control water erosion and prevent compaction.

The Larvie soil is suited to windbreaks and environmental plantings, and the Hisle soil is generally unsuited. The Larvie soil takes in water slowly, and the clayey subsoil in both soils can restrict the penetration of plant roots. The sodium-affected subsoil is a limitation in areas of the Hisle soil. Trees and shrubs can be established on the Larvie soil, but optimum growth is unlikely. No trees or shrubs grow well on the Hisle soil.

The Larvie soil is in capability unit IVe-14, Clayey range site, and windbreak suitability group 4C. The Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

Lo—Lohmiller silty clay. This deep, well drained, level soil is on high flood plains. It is subject to rare flooding for very brief periods. Areas are irregular in shape and are 20 to 400 acres in size. Slopes are smooth.

Typically, the surface layer is light brownish gray silty clay about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, stratified silty clay loam and silty clay. The soil is calcareous throughout. In some areas the surface layer is thicker and darker.

Included with this soil in mapping are small areas of Arvada, Haverson, and Kyle soils. These soils make up less than 15 percent of any one mapped area. Arvada and Haverson soils are in landscape positions similar to those of the Lohmiller soil. Arvada soils have a sodium-affected subsoil. Haverson soils have less clay than the Lohmiller soil. Kyle soils are on the gently sloping foot slopes adjoining the flood plains. They are not stratified and have more clay than the Lohmiller soil.

The content of organic matter is moderately low in the Lohmiller soil. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. It can become compacted if farmed when wet. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Moisture conservation is the most important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture. In some years floodwater may delay planting, but in most years the additional moisture is beneficial and flood damage is minor.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 1.

Lp—Lohmiller silty clay, channeled. This deep, well drained, nearly level soil is on low flood plains that are dissected into small tracts by narrow stream channels. It is occasionally flooded for brief periods. Areas are long and narrow and are 20 to 150 acres in size. Slopes are smooth.

Typically, the surface layer is light brownish gray silty clay about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, stratified silty clay loam and silty clay. The soil is calcareous throughout. In some areas the surface layer is thicker and darker.

Included with this soil in mapping are small areas of Arvada, Haverson, Kyle, and Pierre soils. These soils make up less than 10 percent of any one mapped area. Arvada and Haverson soils are in landscape positions similar to those of the Lohmiller soil. Arvada soils have a sodium-affected subsoil. Haverson soils have less clay than the Lohmiller soil. Kyle and Pierre soils are on the uplands adjacent to the flood plains. They are not stratified and have more clay than the Lohmiller soil.

The content of organic matter is moderately low in the Lohmiller soil. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high.

All of the acreage is used for grazing. This soil is suited to rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Green ash, American elm, cottonwood, chokecherry, buffaloberry, and willow grow adjacent to streams in many areas.

This soil is generally unsuited to cultivated crops because it is dissected into small tracts and is subject to spring flooding. It is suited to tame pasture and hay, but harvesting is difficult because of the channeled landscape. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Because the meandering stream channels can hinder planting by machine, hand planting may be needed.

The capability unit is VIw-1; Loamy Overflow range site; windbreak suitability group 1.

MaB—Manvel silt loam, 0 to 6 percent slopes. This deep, well drained, very gently sloping soil is on foot slopes on plains. Areas are irregular in shape and are 40 to 350 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The next 9 inches is light brownish gray, friable silt loam. The underlying material to a depth of 60 inches is light gray silt loam. The soil is calcareous throughout. In some areas the surface layer is thicker and darker.

Included with this soil in mapping are small areas of Baca, Enning, Minnequa, and Savo soils. These soils make up less than 15 percent of any one mapped area. Baca soils are on foot slopes on alluvial fans. They have more clay than the Manvel soil. Enning and Minnequa soils are on the slightly higher parts of the landscape. Enning soils have bedrock within a depth of 20 inches. Minnequa soils have bedrock within a depth of 20 to 40 inches. Savo soils are in the lower landscape positions. They have more clay in the subsoil than the Manvel soil and have a thicker and darker surface layer.

The content of organic matter is low in the Manvel soil. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. The low fertility and a high content of lime are limitations. Alfalfa, intermediate wheatgrass, and crested wheatgrass are suitable pasture plants. Controlling water erosion and conserving moisture are important management concerns in cultivated areas. Contour farming, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. The high content of lime is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-10; Thin Upland range site; windbreak suitability group 8.

MeC—Manvel-Minnequa silt loams, 2 to 9 percent slopes. These well drained, gently sloping and moderately sloping soils are on dissected plains. The deep Manvel soil is on foot slopes. The moderately deep Minnequa soil is on back slopes. Areas of this map unit are irregular in shape and are 20 to 200 acres in size. They are 45 to 55 percent Manvel soil and 25 to 35 percent Minnequa soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Manvel soil is grayish brown silt loam about 4 inches thick. The next 9 inches is light brownish gray, friable silt loam. The underlying material to a depth of 60 inches is light gray silt loam. The soil is calcareous throughout. In some areas the surface layer is thicker and darker.

Typically, the surface layer of the Minnequa soil is grayish brown silt loam about 5 inches thick. The next 12 inches is pale brown, friable silt loam. The

underlying material is pale brown silt loam. Light yellowish brown and brownish yellow, interbedded, hard limestone and soft, chalky shale bedrock is at a depth of about 26 inches. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Baca, Enning, Midway, and Savo soils. These included soils make up less than 15 percent of any one mapped area. Baca soils are on alluvial fans. They have more clay than the Manvel and Minnequa soils. Enning and Midway soils are in the slightly higher landscape positions. They have bedrock within a depth of 20 inches. The deep Savo soils are in the lower landscape positions. They have more clay in the subsoil than the Manvel soil and have a thicker and darker surface layer.

The content of organic matter is low in the Manvel and Minnequa soils. Permeability is moderate. Available water capacity is high in the Manvel soil and low in the Minnequa soil. Runoff is medium on both soils. The shrink-swell potential is moderate.

All of the acreage is used for grazing. These soils are suited to rangeland. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

The Manvel soil is suited to cultivated crops and to tame pasture and hay, and the Minnequa soil is generally unsuited. A high content of lime is a limitation. In the steeper areas of the Minnequa soil, water erosion is a hazard if the areas are farmed. Alfalfa, crested wheatgrass, and intermediate wheatgrass are suitable pasture plants. Controlling water erosion and conserving moisture are important management concerns in cultivated areas. Contour farming, leaving crop residue on the surface, and minimizing tillage help to control water erosion and conserve moisture.

These soils are suited to windbreaks and environmental plantings. The high content of lime is a limitation. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely. Planting on the contour helps to control erosion.

The Manvel soil is in capability unit IVe-10. The Minnequa soil is in capability unit VIe-3. Both soils are in Thin Upland range site and windbreak suitability group 8.

MgC—Manvel-Urban land complex, 6 to 15 percent slopes. This map unit consists of a deep, well drained, moderately sloping and strongly sloping Manvel soil and areas of Urban land. It is on foot slopes on dissected plains. Areas of this map unit are irregular in shape and are 10 to 600 acres in size. They are 55 to 65 percent Manvel soil and 25 to 35 percent Urban land. The Manvel soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not possible.

Typically, the surface layer of the Manvel soil is grayish brown silt loam about 4 inches thick. The next 9 inches is light brownish gray, friable silt loam. The underlying material to a depth of 60 inches is light gray silt loam. The soil is calcareous throughout. In some areas the surface layer is thicker and darker.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are residential and consist of single family houses and apartments. Some areas are commercial or industrial sites.

Included in this unit in mapping are small areas of Minnequa and Savo soils. These soils make up less than 15 percent of any one mapped area. Minnequa soils are on the slightly higher parts of the landscape. They have soft shale bedrock at a depth of 20 to 40 inches. Savo soils are in the lower landscape positions. They have more clay in the subsoil than the Manvel soil and have a thicker and darker surface layer.

The content of organic matter is low in the Manvel soil. Permeability is moderate. Available water capacity is high. Runoff is medium on the Manvel soil and rapid on the Urban land. The shrink-swell potential is moderate.

The Manvel soil is fairly well suited to lawns, gardens, and recreational development. Lawns, trees, ornamental shrubs, flower gardens, and vegetable gardens are successful. Irrigation during droughty periods and regular additions of fertilizer help to achieve optimum growth. In areas where cutting has exposed the underlying material, adding organic matter to the soil and mulching can improve the seedbed.

The Manvel soil generally is suited to building site development and most kinds of sanitary facilities. The moderate shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation on sites for septic tank absorption fields. Installing foundation drains, diverting runoff away from the buildings, and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

No interpretive groups are assigned to this unit.

MoE—Midway silty clay loam, 15 to 40 percent slopes. This shallow, well drained, moderately steep and steep soil is on shoulder slopes and the upper back

slopes on dissected plains. Areas are irregular in shape and are 80 to 800 acres in size. Slopes are convex.

Typically, the surface layer is yellowish brown silty clay loam about 4 inches thick. The underlying material is yellowish brown and light brownish gray clay loam. Light brownish gray and brownish yellow, soft, interbedded shale and sandstone bedrock is at a depth of about 16 inches. The soil is calcareous throughout. In some areas the soil has less clay. In other areas it has more clay.

Included with this soil in mapping are small areas of Nihill, Razor, and Savo soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Nihill soils are on back slopes on high terraces. They are gravelly throughout. Razor soils are on the lower back slopes. They have shale bedrock at a depth of 20 to 40 inches. Savo soils are on the upper foot slopes. They do not have shale within a depth of 40 inches. They have a surface layer that is darker and thicker than that of the Midway soil. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support grazable vegetation.

The content of organic matter is low in the Midway soil. Permeability is slow. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is high.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Sites for stock water impoundments are available, but seepage can be a problem.

This soil is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope.

The capability unit is VIIe-5; Shallow Clay range site; windbreak suitability group 10.

MosE—Midway clay loam, 15 to 40 percent slopes, stony. This shallow, well drained, moderately steep and steep soil is on shoulder slopes and the upper back slopes on dissected plains. Stones cover 20 to 35 percent of the surface. Areas are irregular in shape and are 80 to 800 acres in size.

Typically, the surface layer is dark grayish brown stony clay loam about 4 inches thick. The underlying material is grayish brown and pale brown clay loam. Gray and pale brown, soft shale bedrock is at a depth of about 18 inches. The soil is calcareous throughout. In some areas the surface layer is darker and thicker.

Included with this soil in mapping are small areas of Conata, Emigrant, and Norrest soils. These soils make up less than 15 percent of any one mapped area. Conata soils are in landscape positions similar to those of the Midway soil. They have more clay than the Midway soil. Emigrant soils are on back slopes. They have a dark, thick surface layer and are 20 to 40 inches deep over bedrock. Norrest soils are on the lower back slopes. They are 20 to 40 inches deep over mudstone bedrock.

The content of organic matter is low in the Midway soil. Permeability is slow. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is high.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Sites for stock water impoundments are available, but seepage can be a problem.

This soil is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope and the surface stoniness.

The capability unit is VIIs-6; Shallow Clay range site; windbreak suitability group 10.

MpD—Midway-Urban land complex, 9 to 30 percent slopes. This map unit consists of a shallow, well drained, strongly sloping to steep Midway soil and areas of Urban land. It is on shoulder slopes and the upper back slopes on dissected plains. Areas of this map unit are irregular in shape and are 40 to 200 acres in size. They are 50 to 60 percent Midway soil and 25 to 35 percent Urban land. The Midway soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Midway soil is grayish brown clay loam about 4 inches thick. The underlying material is grayish brown and pale brown clay loam. Gray and pale brown, soft shale bedrock is at a depth of about 18 inches. The soil is calcareous throughout. In some areas the soil has less clay.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are commercial or industrial. In some areas there are single family houses or apartments.

Included in this unit in mapping are small areas of Minnequa, Razor, and Savo soils and Rock outcrop.

These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Minnequa and Razor soils are on the lower back slopes. They are 20 to 40 inches deep over bedrock. Minnequa soils have less clay than the Midway soil. Savo soils are on the upper foot slopes. They do not have shale bedrock within a depth of 40 inches. They have a surface layer that is thicker and darker than that of the Midway soil. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support vegetation.

The content of organic matter is low in the Midway soil. Permeability is slow. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is high.

The Midway soil is poorly suited to lawns, gardens, and recreational development because of the shallowness to bedrock and the slope. Additions of topsoil may be needed to overcome a shallow rooting depth.

The Midway soil is poorly suited to building site development and sanitary facilities because of the shallowness to bedrock, the high shrink-swell potential, and the slope. Reinforcing foundations and footings, backfilling with sandy material, installing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The base material for streets and roads needs to be strengthened to support vehicular traffic.

No interpretive groups are assigned to this unit.

MrC—Minnequa-Penrose complex, 6 to 9 percent slopes. These well drained, moderately sloping soils are on dissected plains. The moderately deep Minnequa soil is on the lower back slopes. The shallow Penrose soil is on shoulder slopes along drainageways, on other shoulder slopes, and on the upper back slopes. Areas of this map unit are irregular in shape and are 40 to 150 acres in size. They are 55 to 65 percent Minnequa soil and 20 to 30 percent Penrose soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Minnequa soil is grayish brown silt loam about 5 inches thick. The next 12 inches is pale brown, friable silt loam. The underlying material is pale brown silt loam. Light yellowish brown and brownish yellow, interbedded, hard limestone and soft, chalky shale bedrock is at a depth of about 26 inches. The soil is calcareous throughout. In some areas the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Penrose soil is very pale brown loam about 4 inches thick. The underlying material is very pale brown channery loam. Light gray, interbedded, hard limestone bedrock is at a depth of about 15 inches. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Baca and Savo soils and Rock outcrop. These included soils and Rock outcrop make up less than 10 percent of any one mapped area. Baca soils are on high terraces. Savo soils are on the upper foot slopes. They are more than 40 inches deep over bedrock. They have a surface layer that is darker and thicker than that of the Minnequa and Penrose soils. The Rock outcrop occurs in a random pattern throughout areas of the Penrose soil. It does not support grazable vegetation.

The content of organic matter is low in the Minnequa and Penrose soils. Permeability is moderate in both soils. Available water capacity is low in the Minnequa soil and very low in the Penrose soil. Runoff is medium on both soils. The shrink-swell potential is moderate in the Minnequa soil and low in the Penrose soil.

All of the acreage is used for grazing. These soils are suited to rangeland. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are generally unsuited to cultivated crops. The low fertility, a high content of lime, and the depth to bedrock are limitations.

The Minnequa soil is suited to tame pasture and hay, and the Penrose soil is generally unsuited. The shallowness to bedrock is a limitation in areas of the Penrose soil. Alfalfa, intermediate wheatgrass, and western wheatgrass are suitable pasture plants.

The Minnequa soil is suited to windbreaks and environmental plantings, and the Penrose soil is unsuited. The high content of lime in the Minnequa soil and the shallowness to bedrock in the Penrose soil are limitations. Trees and shrubs can be established on the Minnequa soil, but optimum survival, growth, and vigor are unlikely. No trees or shrubs grow well on the Penrose soil.

The Minnequa soil is in capability unit VIe-3, Thin Upland range site, and windbreak suitability group 8. The Penrose soil is in capability unit VIs-1, Shallow range site, and windbreak suitability group 10.

NdE—Nihill gravelly loam, 9 to 40 percent slopes. This deep, excessively drained, strongly sloping to steep soil is on back slopes on high terrace scarps. Areas are irregular in shape and are 20 to 150 acres in size. Slopes are convex.

Typically, the surface layer is brown gravelly loam about 5 inches thick. The underlying material to a depth

of 60 inches is light brownish gray very gravelly loam. The soil is calcareous throughout, and carbonate coatings are on the underside of pebbles.

Included with this soil in mapping are small areas of Nunn, Pierre, Satanta, and Zigweid soils. These soils make up less than 15 percent of any one mapped area. Nunn and Satanta soils are on summits. They are well drained and do not have gravelly material within a depth of 60 inches. Pierre soils are on back slopes and are well drained. They have more clay than the Nihill soil and have shale bedrock within a depth of 20 to 40 inches. Zigweid soils are in landscape positions similar to those of the Nihill soil. They have less gravel than the Nihill soil.

The content of organic matter is low in the Nihill soil. Permeability is moderately rapid. Available water capacity is low. Runoff is rapid.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope, droughtiness, and the shallowness to very gravelly material.

The capability unit is VIs-4; Very Shallow range site; windbreak suitability group 10.

NeD—Nihill very gravelly loam, 0 to 25 percent slopes. This deep, excessively drained, nearly level to moderately steep soil is in partially revegetated excavations from which sand and gravel have been removed. The soil is on back slopes on high terraces. Areas are irregular in shape and are 15 to 80 acres in size. Slopes are broken and consist of unevenly mounded gravelly material.

Typically, the surface layer has been removed during excavation. The remaining material, to a depth of 60 inches, generally consists of light brownish gray very gravelly loam. In some areas the surface layer is dominantly loam.

Included with this soil in mapping are small areas of Nunn and Satanta soils and low, ponded areas. These included areas make up less than 20 percent of any one mapped area. Nunn and Satanta soils are on back slopes adjacent to the excavations. They have a thick, dark surface layer and do not have gravel within a depth of 60 inches. The low, ponded areas generally are the result of a perched water table.

The content of organic matter is low in the Nihill soil. Permeability is moderately rapid. Available water capacity is low. Runoff is slow.

Areas of this map unit are best suited to wildlife habitat. They can be restored if reclamation measures are applied. These measures include leveling and applying topsoil, seeding, and adding fertilizer.

This soil has limited grazable vegetation because areas have been disturbed by excavation. The current vegetation consists of weeds, forbs, sedges, and small patches of sweet clover.

This soil is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings. The lack of topsoil, choppy slopes, and the shallowness to very gravelly material are limitations.

The capability unit is VIIs-6; Very Shallow range site; windbreak suitability group 10.

NgA—Norka silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on foot slopes on plains. Areas are irregular in shape and are 40 to 400 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The next 3 inches is also dark grayish brown silt loam. The subsoil is about 11 inches thick. It is grayish brown, firm silty clay loam in the upper part and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous, stratified silt loam.

Included with this soil in mapping are small areas of Beckton and Savo soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are in the slightly lower positions on the landscape. Savo soils are in landscape positions similar to those of the Norka soil. They have more clay in the subsoil than the Norka soil.

The content of organic matter is moderate in the Norka soil. Permeability is moderate. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Leaving crop residue on the surface and minimizing tillage help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental

plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

NgB—Norka silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on foot slopes on plains. Areas are irregular in shape and are 40 to 200 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The next 3 inches is also dark grayish brown silt loam. The subsoil is about 11 inches thick. It is grayish brown, firm silty clay loam in the upper part and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous, stratified silt loam.

Included with this soil in mapping are small areas of Beckton, Colby, and Savo soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are in the slightly lower landscape positions. Colby soils are in the slightly higher landscape positions. They have a surface layer that is lighter colored than that of the Norka soil. Savo soils are in landscape positions similar to those of the Norka soil. They have more clay in the subsoil than the Norka soil.

The content of organic matter is moderate in the Norka soil. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling water erosion are important management concerns in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to conserve moisture and control water erosion.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting trees on the contour helps to control erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

NhA—Norka-Weta silt loams, 0 to 3 percent slopes. These deep, well drained, nearly level soils are on plains. The Norka soil is on foot slopes. The sodium-affected Weta soil is on the concave lower foot slopes. Areas of this map unit are irregular in shape and are 40 to 300 acres in size. They are 50 to 60 percent Norka soil and 30 to 40 percent Weta soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Norka soil is dark grayish brown silt loam about 4 inches thick. The next 3 inches is also dark grayish brown silt loam. The subsoil is about 11 inches thick. It is grayish brown, firm silty clay loam in the upper part and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous, stratified silt loam.

Typically, the surface layer of the Weta soil is light brownish gray silt loam about 3 inches thick. The subsoil is about 18 inches thick. It is dark grayish brown, very firm clay in the upper part and brown, firm silty clay loam in the lower part. It has accumulations of salts and carbonate in the lower part. The underlying material to a depth of 60 inches is pale brown and light gray, stratified, calcareous silty clay loam, silt loam, and loam.

Included with these soils in mapping are small areas of Blackpipe, Cactusflat, and Cedarpass soils. These included soils make up less than 15 percent of any one mapped area. They are in landscape positions similar to those of the Norka soil. Blackpipe and Cactusflat soils do not have a sodium-affected subsoil. Blackpipe soils have mudstone bedrock at a depth of 20 to 40 inches. Cactusflat soils have more clay than the Norka soil. Cedarpass soils have a surface layer that is lighter colored than that of the Norka soil and have more sodium in the subsoil.

The content of organic matter is moderate in the Norka soil and moderately low in the Weta soil. Permeability is moderate in the Norka soil. It is slow in the subsoil of the Weta soil and moderately slow in the underlying material. Available water capacity is high in the Norka soil and medium in the Weta soil. Runoff is slow on both soils. The shrink-swell potential is moderate in the subsoil of the Norka soil and low in the underlying material. It is high in the subsoil of the Weta soil and moderate in the underlying material. The Weta soil has a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is used for grazing. These soils are suited to rangeland. No hazards or limitations affect the use of the Norka soil for grazing. Compaction is a problem in areas of the Weta soil. Restricted grazing during wet periods helps to prevent compaction. Proper

stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

The Norka soil is suited to cultivated crops, and the Weta soil is generally unsuited. The sodium-affected subsoil restricts plant growth in areas of the Weta soil, and this soil becomes compacted if farmed when wet. Controlling wind erosion and preventing compaction are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to control wind erosion and prevent compaction.

These soils are suited to tame pasture and hay. The sodium-affected subsoil is a limitation in areas of the Weta soil. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants.

The Norka soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. The Weta soil is generally unsuited to windbreaks and environmental plantings, and no trees or shrubs grow well on this soil.

The Norka soil is in capability unit IIIc-1, Silty range site, and windbreak suitability group 3. The Weta soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

NkD—Norrest silty clay loam, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping to strongly sloping soil is on back slopes on dissected plains. Areas are irregular in shape and are 80 to 800 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown silty clay loam about 4 inches thick. The subsoil is light brownish gray, friable silty clay about 14 inches thick. It has accumulations of carbonate in the lower part. The underlying material is white clay loam. It contains 30 percent, by volume, soft fragments of mudstone. Very pale brown, soft mudstone bedrock is at a depth of about 29 inches. The soil is calcareous throughout. In some areas carbonates are leached to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Blackpipe, Fairburn, Midway, and Wortman soils. These soils make up less than 15 percent of any one mapped area. Blackpipe soils are on the lower back slopes. They have a surface layer that is thicker and darker than that of the Norrest soil. Fairburn and Midway soils are on shoulder slopes and the upper back slopes. Fairburn soils have mudstone bedrock within a depth of 10 to 20 inches and have less clay than the Norrest soil. Midway soils have shale bedrock within a depth of 10 to 20 inches. Wortman soils are on the lower foot slopes. They have a sodium-affected subsoil.

The content of organic matter is moderate in the Norrest soil. Permeability is moderately slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is generally unsuited to cultivated crops because of the slope and droughtiness. It is suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are suitable pasture plants.

This soil is suited to windbreaks and environmental plantings. The droughtiness is a limitation. Trees and shrubs can be established, but optimum growth, survival, and vigor are unlikely. Planting on the contour helps to control water erosion.

The capability unit is VIe-3; Clayey range site; windbreak suitability group 6R.

NuA—Nunn loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on summits and back slopes on high terraces. Areas are irregular in shape and are 20 to 400 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is grayish brown loam about 7 inches thick. The next 6 inches is dark grayish brown clay loam. The subsoil is brown and grayish brown, firm clay loam about 16 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is olive, calcareous clay loam. In some areas the subsoil has less clay.

Included with this soil in mapping are small areas of Beckton, Hoven, and Pierre soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are on foot slopes. The poorly drained, sodium-affected Hoven soils are in depressions. Pierre soils have shale bedrock at a depth of 20 to 40 inches. They are on the lower back slopes.

The content of organic matter is moderate in the Nunn soil. Permeability is slow. Available water capacity is high. Runoff is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving soil moisture is an important management concern in cultivated areas. Leaving crop residue on the surface

and minimizing tillage help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

NuB—Nunn loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on back slopes on high terraces. Areas are irregular in shape and are 40 to 400 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown loam about 7 inches thick. The next 6 inches is dark grayish brown clay loam. The subsoil is brown and grayish brown, firm clay loam about 16 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is olive, calcareous clay loam. In some areas the subsoil has less clay.

Included with this soil in mapping are small areas of Beckton, Hoven, and Pierre soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are on foot slopes. The poorly drained, sodium-affected Hoven soils are in depressions. Pierre soils have shale bedrock at a depth of 20 to 40 inches. They are on the lower back slopes.

The content of organic matter is moderate in the Nunn soil. Permeability is slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling water erosion are important management concerns in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to conserve moisture and control water erosion.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting trees on the contour helps to control water erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

NuC—Nunn loam, 6 to 12 percent slopes. This deep, well drained, moderately sloping soil is on back slopes on high terraces. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown loam about 7 inches thick. The next 6 inches is dark grayish brown clay loam. The subsoil is brown and grayish brown, firm clay loam about 16 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is olive, calcareous clay loam. In some areas the subsoil has less clay.

Included with this soil in mapping are small areas of Beckton, Hoven, Nihill, and Zigweid soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Beckton soils are on foot slopes. The poorly drained, sodium-affected Hoven soils are in depressions. Nihill and Zigweid soils are on the upper back slopes. Nihill soils are gravelly throughout. Zigweid soils have less clay in the subsoil than the Nunn soil. In areas adjacent to the Black Hills, scattered cobbles and stones, 5 to 15 inches in diameter, are on the surface.

The content of organic matter is moderate in the Nunn soil. Permeability is slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Most of the acreage is used for grazing. No major hazards or limitations affect the use of this soil for rangeland. Water erosion is a management concern if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Water erosion is a hazard. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Controlling water erosion and conserving moisture are important management concerns in cultivated areas. Contour farming, minimizing tillage, and including grasses and legumes in the cropping system help to control water erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting trees on the contour helps to control water erosion.

The capability unit is IVe-1; Silty range site; windbreak suitability group 3.

NvA—Nunn-Beckton complex, 0 to 3 percent slopes. These deep, nearly level soils are on high terraces. The well drained Nunn soils are on back slopes. The moderately well drained, sodium-affected Beckton soils are on foot slopes. Areas of this map unit are irregular in shape and are 40 to 200 acres in size. They are 45 to 55 percent Nunn soil and 30 to 40 percent Beckton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nunn soil is grayish brown loam about 7 inches thick. The next 6 inches is dark grayish brown clay loam. The subsoil is brown and grayish brown, firm clay loam about 16 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is olive, calcareous clay loam. In some areas the subsoil has less clay.

Typically, the surface layer of the Beckton soil is grayish brown silt loam about 4 inches thick. The subsurface layer is gray silt loam about 2 inches thick. The subsoil is dark grayish brown, firm silty clay about 22 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. It has accumulations of carbonate and salts.

Included with these soils in mapping are small areas of Arvada and Hoven soils. These included soils make up less than 10 percent of any one mapped area. They have a sodium-affected subsoil. Arvada soils are in the slightly lower landscape positions. They have a surface layer that is thinner and lighter colored than that of the Beckton soil. The poorly drained Hoven soils are in depressions.

The content of organic matter is moderate in the Nunn and Beckton soils. Permeability is slow in both soils. Available water capacity is high in the Nunn soil and moderate in the Beckton soil. Runoff is slow on both soils. The shrink-swell potential is high. The Beckton soil has a sodium-affected subsoil that adversely affects plant growth.

About half of the acreage is used for grazing. These soils are suited to rangeland. No hazards or limitations affect the use of the Nunn soil for grazing. Compaction is a problem in areas of the Beckton soil. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to cultivated crops and to tame pasture and hay. The sodium-affected subsoil restricts crop growth in areas of the Beckton soil. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and preventing compaction are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

These soils are suited to windbreaks and environmental plantings. The sodium-affected subsoil restricts root penetration in the Beckton soil. All climatically suited trees and shrubs grow well on the Nunn soil, except for those that require an abundant supply of moisture. Trees and shrubs can be established on the Beckton soil, but optimum survival, growth, and vigor are unlikely.

The Nunn soil is in capability unit IIIc-1, Silty range site, and windbreak suitability group 3. The Beckton soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

NvC—Nunn-Beckton complex, 3 to 9 percent slopes. These deep, gently sloping and moderately sloping soils are on high terraces. The well drained Nunn soil is on back slopes. The moderately well drained, sodium-affected Beckton soil is on foot slopes. Areas of this map unit are irregular in shape and are 40 to 150 acres in size. They are 45 to 55 percent Nunn soil and 30 to 40 percent Beckton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nunn soil is grayish brown loam about 7 inches thick. The next 6 inches is dark grayish brown clay loam. The subsoil is brown and grayish brown, firm clay loam about 16 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is olive, calcareous clay loam. In some areas the subsoil has less clay.

Typically, the surface layer of the Beckton soil is grayish brown silt loam about 4 inches thick. The subsurface layer is gray silt loam about 2 inches thick. The subsoil is dark grayish brown, firm silty clay about 22 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. It has accumulations of carbonate and salts.

Included with these soils in mapping are small areas of Arvada, Hoven, Nihill, and Zigweid soils. These included soils make up less than 15 percent of any one mapped area. The sodium-affected Arvada soils are in the slightly lower landscape positions. They have a surface layer that is thinner and lighter colored than that of the Beckton soil. The poorly drained Hoven soils are in depressions. Nihill soils are gravelly throughout. They are on back slopes. Zigweid soils have less clay in the subsoil than the Nunn and Beckton soils. They are on shoulder slopes.

The content of organic matter is moderate in the

Nunn and Beckton soils. Permeability is slow in both soils. Available water capacity is high in the Nunn soil and moderate in the Beckton soil. Runoff is medium on both soils. The shrink-swell potential is high. The Beckton soil has a sodium-affected subsoil that adversely affects the growth of most plants.

About half of the acreage is used for grazing. These soils are suited to rangeland. No hazards or limitations affect the use of the Nunn soil for grazing. Compaction is a problem in areas of the Beckton soil. Restricted grazing during wet periods helps to prevent compaction. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to cultivated crops and to tame pasture and hay. The sodium-affected subsoil restricts crop growth in areas of the Beckton soil. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Water erosion and compaction are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to control erosion and prevent compaction.

These soils are suited to windbreaks and environmental plantings. The sodium-affected subsoil restricts root penetration in areas of the Beckton soil. All climatically suited trees and shrubs grow well on the Nunn soil, except for those that require an abundant supply of moisture. Trees or shrubs can be established on the Beckton soil, but optimum survival, growth, and vigor are unlikely. Planting trees on the contour helps to control water erosion.

The Nunn soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 3. The Beckton soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

NwA—Nunn-Urban land complex, 0 to 3 percent slopes. This map unit consists of a deep, well drained, nearly level Nunn soil and areas of Urban land. It is on back slopes on high terraces. Areas of this map unit are irregular in shape and are 20 to 400 acres in size. They are 50 to 60 percent Nunn soil and 20 to 30 percent Urban land. The Nunn soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nunn soil is grayish brown loam about 7 inches thick. The next 6 inches is dark grayish brown clay loam. The subsoil is brown and grayish brown, firm clay loam about 16 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is olive, calcareous clay loam. In some areas the subsoil has less clay.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are residential and consist of single family houses and apartments. Some areas are commercial or industrial sites. Very brief, local flooding can occur in low areas during periods of heavy rainfall.

Included in this unit in mapping are small areas of Beckton soils. These soils make up less than 10 percent of any one mapped area. They are moderately well drained and are on foot slopes. They have a sodium-affected subsoil.

The content of organic matter is moderate in the Nunn soil. Permeability is slow. Available water capacity is high. Runoff is slow on the Nunn soil and rapid on the Urban land. The shrink-swell potential is high in the subsoil of the Nunn soil and moderate in the underlying material.

The Nunn soil is well suited to lawns, gardens, and recreational development. Lawns, trees, ornamental shrubs, flower gardens, and vegetable gardens generally are successful. Irrigation during droughty periods and regular additions of fertilizer help to achieve optimum growth. In areas where cutting has exposed the subsoil, adding organic matter to the soil and mulching can improve the seedbed.

The Nunn soil generally is suited to building site development and most kinds of sanitary facilities. The high shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation on sites for septic tank absorption fields. Installing foundation drains, diverting runoff away from the buildings, and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

No interpretive groups are assigned to this unit.

ObE—Orella-Badland complex, 9 to 45 percent slopes. This map unit consists of a shallow, well drained, strongly sloping to steep Orella soil and areas of Badland. It is on dissected plains. The Orella soil is on vegetated shoulder slopes and the upper back slopes. The Badland is in steep, barren areas on escarpments, mounds, and pinnacles. Areas of this map unit are irregular in shape and are 40 to 800 acres in size. They are 45 to 55 percent Orella soil and 35 to 45 percent Badland. The Orella soil and Badland occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Orella soil is grayish brown clay about 3 inches thick. The next 5 inches is light gray, firm clay. It contains about 15 percent, by volume, soft fragments of mudstone. The underlying material is light gray clay. It contains about 45 percent, by volume, soft fragments of mudstone. White and pale yellow, soft mudstone bedrock is at a depth of about 14 inches. The soil is calcareous throughout.

The Badland consists of exposures of the Brule, Chadron, and Pierre Formations. It supports little or no vegetation.

Included in this unit in mapping are small areas of Cedarpass, Denby, Interior, and Whitewater soils. These soils make up less than 15 percent of any one mapped area. Cedarpass and Denby soils are on summits. Interior soils are in the slightly lower landscape positions. They are more than 20 inches deep over bedrock. Whitewater soils are on foot slopes. They have bedrock at a depth of 20 to 40 inches.

The content of organic matter is low in the Orella soil. Permeability is very slow. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is high. The Orella soil has a high content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. The Orella soil is suited to rangeland. The Badland does not support vegetation. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and help to control water erosion.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope, the shallowness to bedrock, the high content of sodium, and the Badland.

The Orella soil is in capability unit VIIe-5 and Shallow Clay range site. The Badland is in capability unit VIIIs-2 and is not assigned a range site. The Orella soil and the Badland are both in windbreak suitability group 10

OeE—Orella-Interior-Badland complex, 0 to 25 percent slopes. This map unit consists of well drained, nearly level to moderately steep soils and areas of Badland. It is on plains that are dissected by entrenched drainageways. The shallow Orella soil is on shoulder slopes and the upper back slopes. The deep, nearly level Interior soil is on high flood plains. It is frequently flooded for brief periods. The Badland is in steep, barren areas on escarpments, mounds, and pinnacles. Areas of this map unit are irregular in shape and are 10 to 200 acres in size. They are 30 to 40 percent Orella soil, 25 to 35 percent Interior soil, and 15 to 25 percent Badland. The two soils and Badland occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Orella soil is grayish brown clay about 3 inches thick. The next 5 inches is light gray, firm clay that contains about 15 percent, by volume, soft fragments of mudstone. The underlying material is light gray clay. It contains about 45 percent, by volume, soft fragments of mudstone. White and pale yellow, soft mudstone bedrock is at a depth of about 14 inches. The soil is calcareous throughout.

Typically, the surface layer of the Interior soil is light gray loam about 2 inches thick. The underlying material to a depth of 60 inches is white and light gray, stratified silt loam and silty clay loam. The soil is calcareous throughout. In some areas the surface layer is silty clay.

The Badland consists of exposures of the Brule, Chadron, and Pierre Formations. It supports little or no vegetation.

Included in this unit in mapping are small areas of Cedarpass, Denby, and Whitewater soils. These soils make up less than 15 percent of any one mapped area. Denby and Cedarpass soils are on summits. Denby soils have more clay throughout than the Interior soil. The deep Cedarpass soils have a surface layer that is darker than that of the Interior soil and are less stratified. Whitewater soils are on foot slopes. They are 20 to 40 inches deep over bedrock.

The content of organic matter is low in the Orella and Interior soils. Permeability is very slow in the Orella soil and moderately slow in the Interior soil. Available water capacity is very low in the Orella soil and high in the Interior soil. Runoff is rapid on the Orella soil, slow on the Interior soil, and very rapid on the Badland. The shrink-swell potential is high in the Orella soil and low in the Interior soil. These soils have a high content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. The Orella and Interior soils are suited to rangeland. The Badland does not support vegetation. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and help to control water erosion.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The high content of sodium, the slope, the shallowness to bedrock, and the Badland are limitations.

The Orella soil is in capability unit VIIe-5 and Shallow Clay range site. The Interior soil is in capability unit VIw-1 and Badland Overflow range site. The Badland is in capability unit VIIIs-1 and is not assigned a range site. The Orella and Interior soils and the Badland are in windbreak suitability group 10.

OtA—Ottumwa clay, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on the lower back slopes and foot slopes on plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 40 to 400 acres in size. Slopes are smooth.

Typically, the surface layer is olive gray clay about 7 inches thick. The subsoil is olive gray and olive, firm and very firm clay about 35 inches thick. It has accumulations of carbonate and gypsum in the lower part. The underlying material is olive gray, calcareous silty clay. It contains about 55 percent, by volume, fragments of shale. Light gray, soft shale bedrock is at a depth of about 51 inches. In some areas the depth to shale is less than 40 inches.

Included with this soil in mapping are small areas of Egas, Hisle, and Savo soils. These soils make up less than 10 percent of any one mapped area. Egas and Hisle soils are in the lower landscape positions. Egas soils have accumulations of salts at or near the surface. Hisle soils have a sodium-affected subsoil. Savo soils are in landscape positions similar to those of the Ottumwa soil. They have less clay than the Ottumwa soil.

The content of organic matter is moderate in the Ottumwa soil. Permeability is slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. It can become compacted if farmed when wet. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture and preventing compaction are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

This soil is suited to rangeland. Compaction is a management concern. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IIIs-1; Clayey range site; windbreak suitability group 4C.

OtB—Ottumwa clay, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on foot slopes and the lower back slopes on plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 40 to 400 acres in size. Slopes are convex.

Typically, the surface layer is olive gray clay about 7 inches thick. The subsoil is olive gray and olive, firm and very firm clay about 35 inches thick. It has accumulations of carbonate and gypsum in the lower part. The underlying material is olive gray, calcareous silty clay. It contains about 55 percent, by volume, fragments of shale. Light gray, soft shale bedrock is at a depth of about 51 inches. In some areas the depth to shale is less than 40 inches.

Included with this soil in mapping are small areas of Egas, Hisle, Razor, and Savo soils. These soils make up less than 15 percent of any one mapped area. Egas and Hisle soils are in the lower landscape positions. Egas soils have accumulations of salts at or near the surface. Hisle soils have a sodium-affected subsoil. Razor soils are on shoulder slopes. They have a surface layer that is lighter colored than that of the Ottumwa soil. They are 20 to 40 inches deep over shale bedrock. Savo soils are in landscape positions similar to those of the Ottumwa soil. They have less clay than the Ottumwa soil.

The content of organic matter is moderate in the Ottumwa soil. Permeability is slow. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay (fig. 8). It can become compacted if farmed when wet. Alfalfa, western wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Controlling water erosion and preventing compaction are important management concerns in cultivated areas. Contour farming, leaving crop residue on the surface, minimizing tillage, and subsoiling or deep chiseling help to control water erosion and prevent compaction.

This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

Figure 8.—An area of Ottumwa clay, 2 to 6 percent slopes, used for alfalfa hay.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IIIe-3; Clayey range site; windbreak suitability group 4C.

OvC—Ottumwa-Razor complex, 6 to 9 percent slopes. These well drained, moderately sloping soils are on dissected plains. The deep Ottumwa soil is on the lower back slopes and foot slopes. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. The moderately deep Razor soil is on the upper back slopes. Areas of this map unit are irregular in shape and are 30 to 450 acres in size. They are 50 to 60 percent Ottumwa soil and 25 to 35 percent Razor soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ottumwa soil is olive gray clay about 7 inches thick. The subsoil is olive gray and olive, firm and very firm clay about 35 inches thick. It has accumulations of carbonate and gypsum in the lower part. The underlying material is olive gray, calcareous silty clay. It contains about 55 percent, by volume, fragments of shale. Light gray, soft shale bedrock is at a depth of about 51 inches. In some areas the depth to shale is less than 40 inches.

Typically, the surface layer of the Razor soil is grayish brown silty clay about 4 inches thick. The subsoil is light yellowish brown and pale olive, firm silty clay about 22 inches thick. The underlying material is pale olive clay loam. Light gray, soft shale bedrock is at a depth of about 30 inches. The soil is calcareous throughout. In some areas the surface layer is thicker and darker.

Included with these soils in mapping are small areas of Egas, Hisle, Midway, and Savo soils. These included soils make up less than 15 percent of any one mapped area. Egas and Hisle soils are in the lower landscape positions. Egas soils have accumulations of salts at or near the surface. Hisle soils have a sodium-affected subsoil. Midway soils are in the slightly higher landscape positions. They are 10 to 20 inches deep over shale bedrock. Savo soils are in landscape positions similar to those of the Ottumwa soil. They have less clay than the Ottumwa soil.

The content of organic matter is moderate in the Ottumwa soil and moderately low in the Razor soil. Permeability is slow in both soils. Available water capacity is moderate in the Ottumwa soil and low in the Razor soil. Runoff is medium on both soils. The shrink-swell potential is high.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soils become compacted if farmed when wet. Controlling water erosion, preventing compaction, and conserving moisture are important management concerns in cultivated areas. Contour farming, subsoiling or deep chiseling, and leaving crop residue on the surface help to control water erosion, prevent compaction, and conserve moisture.

These soils are suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Water erosion is a hazard if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to windbreaks and environmental plantings. They take in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control water erosion.

The capability unit is IVe-14; Clayey range site; windbreak suitability group 4C.

Ow—Owanka clay loam. This deep, well drained, nearly level soil is on back slopes on terraces and alluvial fans. Areas are irregular in shape and are 30 to 400 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The subsoil is dark grayish brown and grayish brown, friable clay loam about 29 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay loam. In some areas the surface layer is not so dark.

Included with this soil in mapping are small areas of Colombo and Haverson soils. These soils make up less than 10 percent of any one mapped area. They are in landscape positions slightly lower than those of the Owanka soil. The soils are stratified. They have less clay than the Owanka soil. Haverson soils have a light colored surface layer.

The content of organic matter is moderate in the Owanka soil. Permeability is moderately slow. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture. In some years floodwater may delay planting, but in most years the additional moisture is beneficial and flood damage is minor.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 3.

Ox—Owanka-Beckton complex. These deep, nearly level soils are on terraces and alluvial fans. The well drained Owanka soil is on back slopes. The moderately well drained, sodium-affected Beckton soil is on foot slopes. Areas of this map unit are irregular in shape and are 40 to 350 acres in size. They are 40 to 50 percent Owanka soil and 35 to 45 percent Beckton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Owanka soil is dark grayish brown clay loam about 6 inches thick. The subsoil is dark grayish brown and grayish brown, friable clay loam about 29 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay loam. In some areas the surface layer is not so dark.

Typically, the surface layer of the Beckton soil is grayish brown silt loam about 4 inches thick. The subsurface layer is gray silt loam about 2 inches thick. The subsoil is dark grayish brown, firm silty clay about 22 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. It has accumulations of carbonate and salts.

Included with these soils in mapping are small areas of Arvada and Kyle soils. These included soils make up less than 10 percent of any one mapped area. Arvada soils are slightly lower on the landscape than the Beckton soil. They have a surface layer that is thinner and lighter colored than that of the Beckton soil. Kyle

soils are on foot slopes. They have more clay than the Owanka and Beckton soils.

The content of organic matter is moderate in the Owanka and Beckton soils. Permeability is moderately slow in the Owanka soil and slow in the Beckton soil. Available water capacity is moderate in both soils. Runoff is slow. The shrink-swell potential is high. The Beckton soil has a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem in areas of the Beckton soil. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to cropland and to tame pasture and hay. The sodium-affected subsoil restricts crop growth in areas of the Beckton soil. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Conserving moisture and preventing compaction are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

These soils are suited to windbreaks and environmental plantings. The sodium-affected subsoil restricts root penetration in areas of the Beckton soil. All climatically suited trees and shrubs grow well on the Owanka soil, except for those that require an abundant supply of moisture. Trees and shrubs can be established on the Beckton soil, but optimum growth, survival, and vigor are unlikely.

The Owanka soil is in capability unit IIIc-2, Loamy Terrace range site, and windbreak suitability group 3. The Beckton soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

PdF—Penrose-Rock outcrop complex, 9 to 60 percent slopes. This map unit consists of a shallow, well drained, strongly sloping to very steep Penrose soil and areas of Rock outcrop. It is on dissected plains. Many small rocks and fragments of limestone are scattered on the surface. The Penrose soil is on shoulder slopes and the upper back slopes. The Rock outcrop occurs mainly as ledges and escarpments on the higher parts of the landscape. Areas of this map unit are oblong and are 80 to 400 acres in size. They are 55 to 65 percent Penrose soil and 15 to 25 percent Rock outcrop. The Penrose soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Penrose soil is very pale brown loam about 4 inches thick. The underlying material is very pale brown channery loam. Light gray, hard, interbedded limestone bedrock is at a depth of about 15 inches. The soil is calcareous throughout.

The Rock outcrop is limy shale and hard limestone. It generally does not support vegetation.

Included in this unit in mapping are small areas of Midway and Minnequa soils. These soils make up less than 10 percent of any one mapped area. Midway soils are in landscape positions similar to those of the Penrose soil. They have more clay than the Penrose soil. Minnequa soils are on foot slopes. They are 20 to 40 inches deep over bedrock.

The content of organic matter is low in the Penrose soil. Permeability is moderate. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is low.

All of the acreage is used for grazing. The Penrose soil is suited to rangeland. Water erosion is an important management concern in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control erosion.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope and the shallowness to bedrock.

The Penrose soil is in capability unit VIIe-1 and Shallow range site. The Rock outcrop is in capability unit VIIIs-1 and is not assigned a range site. The Penrose soil and the Rock outcrop are both in windbreak suitability group 10.

PeB—Pierre clay, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on back slopes on plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 40 to 200 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown clay about 5 inches thick. The subsoil is grayish brown and olive gray, firm, calcareous clay about 21 inches thick. It has soft fragments of shale and accumulations of carbonate in the lower part. The underlying material is light gray, calcareous clay. It contains about 20 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Grummit, Hisle, Lohmiller, and Samsil soils. These soils make up less than 10 percent of any one mapped area.

The shallow Grummit and Samsil soils are on the higher parts of the landscape. The sodium-affected Hisle soils are on the lower back slopes. Lohmiller soils are on high flood plains. They are stratified and do not have bedrock within a depth of 60 inches.

The content of organic matter is moderately low in the Pierre soil. Permeability is very slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, western wheatgrass, and crested wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Controlling water erosion and preventing compaction are important management concerns in cultivated areas. Contour farming, subsoiling or deep chiseling, and leaving crop residue on the surface help to control water erosion, prevent compaction, and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

PeC—Pierre clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on back slopes on dissected plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 40 to 350 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown clay about 5 inches thick. The subsoil is grayish brown and olive gray, firm, calcareous clay about 21 inches thick. It contains soft fragments of shale and accumulations of carbonate in the lower part. The underlying material is light gray, calcareous clay. It contains 20 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Grummit, Hisle, Lohmiller, and Samsil soils. These soils make up less than 15 percent of any one mapped area. Grummit and Samsil soils are on the higher parts of the landscape. They have shale bedrock within a depth of 20 inches. The sodium-affected Hisle soils are on the lower back slopes. Lohmiller soils are on high flood plains. They are stratified and do not have bedrock within a depth of 60 inches.

The content of organic matter is moderately low in the Pierre soil. Permeability is very slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Water erosion is a hazard if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Controlling water erosion, preventing compaction, and conserving moisture are important management concerns in cultivated areas. Contour farming, subsoiling or deep chiseling, and leaving crop residue on the surface help to control erosion, prevent compaction, and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control water erosion.

The capability unit is IVe-14; Clayey range site; windbreak suitability group 4C.

PeD—Pierre clay, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping and strongly sloping soil is on back slopes on dissected plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 20 to 500 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown clay about 5 inches thick. The subsoil is grayish brown and olive gray, firm, calcareous clay about 21 inches thick. It contains soft fragments of shale and accumulations of carbonate in the lower part. The underlying material is light gray, calcareous clay. It contains 20 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of

Grummit, Hisle, and Samsil soils. These soils make up less than 10 percent of any one mapped area. The shallow Grummit and Samsil soils are on the higher parts of the landscape. The sodium-affected Hisle soils are on the lower back slopes.

The content of organic matter is moderately low in the Pierre soil. Permeability is very slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Water erosion is a hazard if the rangeland is overgrazed. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Sites for stock water impoundments are available in some areas.

This soil generally is unsuited to cultivated crops. The slope is the main limitation. The less sloping areas can be used for tame pasture and hay. The soil takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Intermediate wheatgrass and western wheatgrass are examples of suitable pasture plants.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. The slope and the hazard of erosion are additional limitations. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control water erosion.

The capability unit is VIe-4; Clayey range site; windbreak suitability group 4C.

PgD—Pierre-Grummit clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on dissected plains. The moderately deep Pierre soil is on back slopes. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. The shallow Grummit soil is on shoulder slopes and the upper back slopes. Areas of this map unit are irregular in shape and are 40 to 200 acres in size. They are 55 to 65 percent Pierre soil and 25 to 35 percent Grummit soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is dark grayish brown clay about 5 inches thick. The subsoil is grayish brown and olive gray, firm, calcareous clay about 21 inches thick. It contains soft fragments of shale and accumulations of carbonate in the lower part. The underlying material is light gray, calcareous clay. It contains 20 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Grummit soil is gray clay about 3 inches thick. The underlying material is also gray clay. It contains 25 percent, by volume, soft fragments of shale. Gray, platy, soft, acid shale bedrock is at a depth of about 12 inches.

Included with these soils in mapping are small areas of Hisle, Lohmiller, and Nihill soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Hisle soils are on the lower back slopes. They have a sodium-affected subsoil. Lohmiller soils are on high flood plains. They do not have shale bedrock within a depth of 40 inches. They are stratified. Nihill soils are on back slopes. They are gravelly throughout. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support grazable vegetation.

The content of organic matter is moderately low in the Pierre and Grummit soils. Permeability is very slow in the Pierre soil and moderately slow in the Grummit soil. Available water capacity is low in the Pierre soil and very low in the Grummit soil. Runoff is medium on both soils. The shrink-swell potential is very high in the Pierre soil and high in the Grummit soil.

All of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem, and water erosion is a hazard in overgrazed areas. Restricted grazing during wet periods helps to prevent compaction. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Sites for stock water impoundments are available in some draws, but seepage can be a problem.

The Pierre soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C. The Grummit soil is in capability unit VIe-12, Shallow Clay range site, and windbreak suitability group 10.

PhB—Pierre-Hisle complex, 0 to 9 percent slopes. These moderately deep, well drained, nearly level to moderately sloping soils are on dissected plains. The Pierre soil is on the upper back slopes. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. The sodium-affected Hisle soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 40 to 300 acres in size. They are 50 to 60 percent Pierre soil and 30 to 40 percent Hisle soil. The two soils occur

as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is dark grayish brown clay about 5 inches thick. The subsoil is grayish brown and olive gray, firm, calcareous clay about 21 inches thick. It contains soft fragments of shale and accumulations of carbonate in the lower part. The underlying material is light gray, calcareous clay. It contains 20 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 2 inches thick. The subsoil is brown and pale brown, very firm, calcareous silty clay about 19 inches thick. It has accumulations of salts and carbonate in the lower part. The underlying material is pale brown, calcareous silty clay. Light gray, calcareous, soft shale bedrock is at a depth of about 28 inches. In some areas the depth to shale is more than 40 inches.

Included with these soils in mapping are small areas of Samsil soils and Slickspots. These included soils and Slickspots make up less than 10 percent of any one mapped area. Samsil soils are on shoulder slopes. They have bedrock within a depth of 20 inches. Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderately low in the Pierre and Hisle soils. Permeability is very slow. Available water capacity is low in the Pierre soil and very low in the Hisle soil. Runoff is medium on both soils. The shrink-swell potential is very high. The Hisle soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

The Pierre soil is suited to cultivated crops and to tame pasture and hay, and the Hisle soil is generally unsuited. The dense, sodium-affected subsoil restricts root penetration in areas of the Hisle soil. Intermediate wheatgrass and western wheatgrass are examples of suitable pasture plants. The soils become compacted if farmed when wet. Controlling water erosion and preventing compaction are important management concerns. Contour farming, leaving crop residue on the surface, and subsoiling or deep chiseling help to control water erosion and prevent compaction.

The Pierre soil is suited to windbreaks and environmental plantings, and the Hisle soil is generally unsuited. The Pierre soil takes in water slowly, and the clayey subsoil in both soils can restrict the penetration of plant roots. The sodium-affected subsoil is a limitation in areas of the Hisle soil. Trees and shrubs can be established on the Pierre soil, but optimum growth is unlikely. No trees or shrubs grow well on the Hisle soil.

The Pierre soil is in capability unit IVe-3, Clayey range site, and windbreak suitability group 4C. The Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

PkC—Pierre-Urban land complex, 6 to 15 percent slopes. This map unit consists of a moderately deep, well drained, moderately sloping and strongly sloping Pierre soil and areas of Urban land. It is on back slopes on dissected plains. When dry, the Pierre soil is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas of this map unit are irregular in shape and are 40 to 200 acres in size. They are 55 to 65 percent Pierre soil and 25 to 35 percent Urban land. The Pierre soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not possible.

Typically, the surface layer of the Pierre soil is dark grayish brown clay about 5 inches thick. The subsoil is grayish brown and olive gray, firm, calcareous clay about 21 inches thick. It contains soft fragments of shale and accumulations of carbonate in the lower part. The underlying material is light gray, calcareous clay. It contains about 20 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are residential and consist of single family houses and apartments. Some areas are commercial or industrial sites.

Included in this unit in mapping are small areas of Hisle and Nunn soils. These soils make up less than 15 percent of any one mapped area. Hisle soils are on the lower back slopes. They have a sodium-affected subsoil. The deep Nunn soils are on back slopes on terraces. They have less clay in the subsoil than the Pierre soil.

The content of organic matter is moderately low in the Pierre soil. Permeability is very slow. Available water capacity is low. Runoff is medium on the Pierre soil and rapid on the Urban land. The shrink-swell potential is very high in the Pierre soil.

The Pierre soil is suited to lawns, gardens, and recreational development. Lawns, trees, ornamental

shrubs, flower gardens, and vegetable gardens are marginally successful. Plant growth can be improved by irrigation during droughty periods and regular additions of fertilizer or organic matter. In areas where cutting has exposed the subsoil, adding organic matter to the soil and mulching can improve the seedbed.

The Pierre soil generally is suited to building site development and sanitary facilities. The very high shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation on sites for septic tank absorption fields. Installing foundation drains, diverting runoff away from the buildings, and reinforcing foundations and footings help to prevent the structural drainage caused by shrinking and swelling. Enlarging the absorption area in septic tank absorption fields helps to overcome the very slow absorption of liquid waste. The base material for streets and roads needs to be strengthened to support vehicular traffic.

No interpretive groups are assigned to this unit.

Ps—Pits, gravel. This map unit consists of open excavations, 5 to 30 feet deep, from which sand and gravel is being removed. Water is ponded in the bottom of some pits. Areas are irregular in shape and range from 20 to 160 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottom to almost vertical on the rims.

The pit bottoms typically are sand or gravel but are shale in some areas. Mounds of mixed overburden are on the edges of the pits. They support annual weeds. The bottom and sides support little or no vegetation.

Most gravel pits are used only as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned gravel pits can be restored to rangeland or to tame pasture and hay if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden as topsoil dressing. Applying fertilizer as needed helps to establish range or pasture plants.

The capability unit is VIIIs-2; windbreak suitability group 10. No range site is assigned.

RaB—Razor silty clay, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on back slopes on plains. Areas are irregular in shape and are 20 to 150 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown silty clay about 4 inches thick. The subsoil is light yellowish brown and pale olive, firm silty clay about 22 inches thick. The underlying material is pale olive clay loam. Light gray, soft shale bedrock is at a depth of about 30 inches. The soil is calcareous throughout. In some areas the surface layer is darker and thicker.

Included with this soil in mapping are small areas of Egas, Midway, Ottumwa, and Savo soils. These soils make up less than 15 percent of any one mapped area. Egas soils are on toe slopes. They have accumulations of salts at or near the surface. Midway soils are on shoulder slopes. They have shale bedrock within a depth of 10 to 20 inches. Ottumwa and Savo soils are on foot slopes. They have shale bedrock below a depth of 40 inches and have a thick, dark surface layer.

The content of organic matter is moderately low in the Razor soil. Permeability is slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, western wheatgrass, and crested wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Controlling water erosion, preventing compaction, and conserving moisture are important management concerns in cultivated areas. Contour farming, subsoiling or deep chiseling, and leaving crop residue on the surface help to control erosion, prevent compaction, and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control water erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

RaC—Razor silty clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on back slopes on dissected plains. Areas are irregular in shape and are 40 to 200 acres in size. Slopes are convex.

Typically, the surface layer is grayish brown silty clay about 4 inches thick. The subsoil is light yellowish brown and pale olive, firm silty clay about 22 inches thick. The underlying material is pale olive clay loam. Light gray, soft shale bedrock is at a depth of about 30 inches. The soil is calcareous throughout. In some areas the surface layer is darker and thicker.

Included with this soil in mapping are small areas of Egas, Midway, Ottumwa, and Savo soils. These soils make up less than 15 percent of any one mapped area. Egas soils are on toe slopes. They have accumulations

of salts at or near the surface. Midway soils are on shoulder slopes. They have shale bedrock at a depth of 10 to 20 inches. Ottumwa and Savo soils are on foot slopes. They have shale bedrock below a depth of 40 inches and have a thick, dark surface layer.

The content of organic matter is moderately low in the Razor soil. Permeability is slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem, and water erosion is a hazard in overgrazed areas. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, western wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet. Controlling water erosion, preventing compaction, and conserving moisture are important management concerns in cultivated areas. Contour farming, subsoiling or deep chiseling, and leaving crop residue on the surface help to control water erosion, prevent compaction, and conserve moisture.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, and the clayey subsoil can restrict the penetration of plant roots. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control water erosion.

The capability unit is IVe-14; Clayey range site; windbreak suitability group 4C.

RbD—Razor-Midway complex, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on dissected plains. The moderately deep Razor soil is on the lower back slopes. The shallow Midway soil is on shoulder slopes and the upper side slopes. Areas of this map unit are irregular in shape and are 20 to 300 acres in size. They are 45 to 55 percent Razor soil and 30 to 40 percent Midway soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Razor soil is grayish brown silty clay about 4 inches thick. The subsoil is light yellowish brown and pale olive, firm silty clay about 22 inches thick. The underlying material is pale olive clay loam. Light gray, soft shale bedrock is at a depth of about 30 inches. The soil is calcareous throughout. In some areas the surface layer is darker and thicker.

Typically, the surface layer of the Midway soil is yellowish brown silty clay loam about 4 inches thick. The underlying material is yellowish brown and light brownish gray clay loam. Light brownish gray and brownish yellow, soft, interbedded shale and sandstone bedrock is at a depth of about 16 inches. The soil is calcareous throughout. In some areas the soil has less clay.

Included with these soils in mapping are small areas of Blackpipe, Egas, Ottumwa, and Savo soils. These included soils make up less than 15 percent of any one mapped area. Blackpipe soils are on summits. They have a thick, dark surface layer. Egas soils are on toe slopes. They have accumulations of salts at or near the surface. The deep Ottumwa and Savo soils are on foot slopes. They have a thick, dark surface layer and do not have shale bedrock within a depth of 40 inches.

The content of organic matter is moderately low in the Razor soil and low in the Midway soil. Permeability is slow in both soils. Available water capacity is low in the Razor soil and very low in the Midway soil. Runoff is medium on both soils. The shrink-swell potential is high.

All of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem, and water erosion is a hazard in overgrazed areas. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Sites for stock water impoundments are plentiful.

These soils are generally unsuited to cultivated crops because of the slope and the shallowness to shale. The less sloping areas of the Razor soil are suited to tame pasture and hay. Western wheatgrass and intermediate wheatgrass are suitable pasture plants.

The Razor soil is suited to windbreaks and environmental plantings, and the Midway soil is unsuited. The Razor soil takes in water slowly, and the clayey subsoil in both soils can restrict the penetration of plant roots. The shallowness to shale is a limitation in areas of the Midway soil. Trees and shrubs can be established on the Razor soil, but optimum growth is unlikely. No trees or shrubs grow well on the Midway soil.

The Razor soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C. The Midway soil is in capability unit VIe-12, Shallow Clayey range site, and windbreak suitability group 10.

Rv—Riverwash. This map unit consists of flood deposits and sand bars in and along the Cheyenne River. It is frequently flooded for brief periods. Areas are long and narrow and are 15 to 100 acres in size. Slopes are convex and choppy.

The Riverwash is coarse textured, alluvial deposits of gravel and sand that are adjacent to or in stream channels. It has a water table at the same depth as the water level of the river. It has little or no vegetation, but willows and cottonwood trees are being established in some areas.

Included with Riverwash in mapping are small areas of Bankard and Glenberg soils. These soils make up less than 15 percent of any one mapped area. They are on the higher vegetated parts of the landscape.

The capability unit is VIIIe-2; windbreak suitability group 10. No range site is assigned.

SbF—Samsil clay, 25 to 40 percent slopes. This shallow, well drained, steep soil is on shoulder slopes and the upper back slopes on plains that are dissected by gullies, ravines, and drainageways. Areas are irregular in shape and are 40 to 1,000 acres in size. Slopes are complex. Vertical cutbanks and landslides occur in some areas.

Typically, the surface layer is light brownish gray clay about 2 inches thick. The next 5 inches is light brownish gray clay. The underlying material is light brownish gray and light olive gray clay. It contains about 30 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 17 inches. The soil is calcareous throughout. In some areas it is noncalcareous or has less clay.

Included with this soil in mapping are small areas of Hisle, Pierre, Schamber, and Shingle soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Hisle and Pierre soils are on the lower back slopes. Hisle soils have a sodium-affected subsoil. Pierre soils have shale bedrock at a depth of 20 to 40 inches. The gravelly Schamber soils are on shoulder slopes. Shingle soils are in landscape positions similar to those of the Samsil soil. They have less clay and more sand than the Samsil soil. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support grazable vegetation.

The content of organic matter is moderately low in the Samsil soil. Permeability is slow. Available water capacity is very low. Runoff is very rapid. The shrink-swell potential is very high.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is a hazard in overgrazed areas. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Sites for stock water impoundments are abundant in draws.

This soil is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope. Rocky Mountain juniper, however, is common in the draws and on the north-facing slopes.

The capability unit is VIIe-5; Shallow Clay range site; windbreak suitability group 10.

ScE—Samsil-Pierre clays, 15 to 25 percent slopes. These well drained, moderately steep soils are on plains that are dissected by deep ravines or gullies. The shallow Samsil soil is on shoulder slopes and the upper back slopes. The moderately deep Pierre soil is on the lower back slopes. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas of this map unit are irregular in shape and are 40 to 1,000 acres in size. They are 50 to 60 percent Samsil soil and 25 to 35 percent Pierre soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical. Slumps or landslides are common in some areas.

Typically, the surface layer of the Samsil soil is light brownish gray clay about 2 inches thick. The next 5 inches is light brownish gray clay. The underlying material is light brownish gray and light olive gray clay. It contains about 30 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 17 inches. The soil is calcareous throughout. In some areas it is noncalcareous or has less clay.

Typically, the surface layer of the Pierre soil is dark grayish brown clay about 5 inches thick. The subsoil is grayish brown and olive gray, firm, calcareous clay about 21 inches thick. It contains soft fragments of shale and accumulations of carbonate in the lower part. The underlying material is light gray, calcareous clay. It contains 20 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Hisle, Lohmiller, and Schamber soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Hisle soils are on the lower back slopes. They have a sodium-affected subsoil. Lohmiller soils are on high flood plains. They are stratified. The gravelly Schamber soils are on shoulder slopes. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support grazable vegetation.

The content of organic matter is moderately low in the Samsil and Pierre soils. Permeability is slow in the Samsil soil and very slow in the Pierre soil. Available water capacity is very low in the Samsil soil and low in the Pierre soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

All of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem, and water erosion is a hazard in overgrazed areas. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Sites for stock water impoundments are plentiful.

These soils are not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope.

The Samsil soil is in capability unit VIe-12 and Shallow Clay range site. The Pierre soil is in capability unit VIe-4 and Clayey range site. Both soils are in windbreak suitability group 10.

SdF—Samsil-Rock outcrop complex, 25 to 75 percent slopes. This map unit consists of a shallow, well drained, steep and very steep Samsil soil and areas of Rock outcrop. It is near entrenched drainageways on dissected plains. The Samsil soil is on the vegetated shoulder slopes and upper back slopes. The Rock outcrop occurs as nearly vertical cutbanks and escarpments. Areas of this map unit are irregular in shape and are 40 to 1,000 acres in size. They are 50 to 60 percent Samsil soil and 25 to 35 percent Rock outcrop. The Samsil soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Samsil soil is light brownish gray clay about 2 inches thick. The next 5 inches is also light brownish gray clay. The underlying material is light brownish gray and light olive gray clay. It contains about 30 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 17 inches. The soil is calcareous throughout. In some areas it is noncalcareous or has less clay.

The Rock outcrop consists of gray shale. It is on cutbanks, slumps, and landslides. It generally does not support vegetation.

Included in this unit in mapping are small areas of Pierre and Schamber soils. These soils make up less than 15 percent of any one mapped area. Pierre soils are on the lower back slopes. They have shale bedrock at a depth of 20 to 40 inches. The gravelly Schamber soils are on shoulder slopes.

The content of organic matter is moderately low in the Samsil soil. Permeability is slow. Available water capacity is very low. Runoff is very rapid. The shrink-swell potential is very high.

All of the acreage is used for grazing. The Samsil soil is suited to rangeland. Compaction is a problem, and water erosion is a hazard in overgrazed areas. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Sites for stock water impoundments are plentiful.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope.

The Samsil soil is in capability unit VIIe-5 and Shallow Clay range site. The Rock outcrop is in capability unit VIIIs-2 and is not assigned a range site. The Samsil soil and the Rock outcrop are both in windbreak suitability group 10.

SeA—Satanta loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on back slopes on high terraces. Areas are irregular in shape and are 40 to 1,000 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The next 5 inches is grayish brown loam. The subsoil is about 16 inches thick. It is yellowish brown, friable clay loam in the upper part and light yellowish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In some areas, the soil is calcareous within a depth of 15 inches or the subsoil has more clay.

Included with this soil in mapping are small areas of Altvan, Beckton, and Hoven soils. These soils make up less than 10 percent of any one mapped area. Altvan soils are in landscape positions similar to those of the Satanta soil. They have gravelly sand at a depth of 20 to 40 inches. The moderately well drained, sodium-affected Beckton soils are on foot slopes. The poorly drained, sodium-affected Hoven soils are in depressions.

The content of organic matter is moderate in the Satanta soil. Permeability is moderate. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are

examples of suitable pasture plants. Moisture conservation is an important management concern in cultivated areas. Leaving crop residue on the surface and minimizing tillage help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

SeB—Satanta loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on back slopes on high terraces. Areas are irregular in shape and are 20 to 400 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The next 5 inches is grayish brown loam. The subsoil is about 16 inches thick. It is yellowish brown, friable clay loam in the upper part and light yellowish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In some places, the soil is calcareous within a depth of 15 inches or the subsoil has more clay.

Included with this soil in mapping are small areas of Altvan, Beckton, and Hoven soils. These soils make up less than 10 percent of any one mapped area. Altvan soils are in landscape positions similar to those of the Satanta soil. They have gravelly sand at a depth of 20 to 40 inches. The moderately well drained, sodium-affected Beckton soils are on foot slopes. The poorly drained, sodium-affected Hoven soils are in depressions.

The content of organic matter is moderate in the Satanta soil. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling water erosion are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to conserve moisture and control water erosion.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting trees on the contour helps to control water erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

SeC—Satanta loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on back slopes on high terraces. Areas are irregular in shape and are 40 to 200 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The next 5 inches is grayish brown loam. The subsoil is about 16 inches thick. It is yellowish brown, friable clay loam in the upper part and light yellowish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In some areas, the soil is calcareous within a depth of 15 inches or the subsoil has more clay.

Included with this soil in mapping are small areas of Altvan, Beckton, Hoven, and Zigweid soils. These soils make up less than 15 percent of any one mapped area. Altvan soils are in landscape positions similar to those of the Satanta soil. They have gravelly sand at a depth of 20 to 40 inches. The moderately well drained, sodium-affected Beckton soils are on foot slopes. The poorly drained, sodium-affected Hoven soils are in depressions. Zigweid soils are on shoulder slopes. They have less clay in the subsoil than the Satanta soil.

The content of organic matter is moderate in the Satanta soil. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

About half of the acreage is used for grazing. Generally, no hazards or limitations affect the use of this soil for rangeland. Water erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

This soil is suited to cultivated crops and to tame pasture and hay, but water erosion is a hazard. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Controlling water erosion and conserving moisture are important management concerns in cultivated areas. Contour farming, minimizing tillage, and including legumes in the

cropping system help to control water erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting trees on the contour helps to control water erosion.

The capability unit is IVe-1; Silty range site; windbreak suitability group 3.

SgA—Satanta-Beckton complex, 0 to 3 percent slopes. These deep, nearly level soils are on high terraces. The well drained Satanta soil is on back slopes. The moderately well drained, sodium-affected Beckton soil is on foot slopes. Areas of this map unit are irregular in shape and are 20 to 300 acres in size. They are 50 to 60 percent Satanta soil and 30 to 40 percent Beckton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Satanta soil is dark grayish brown loam about 6 inches thick. The next 5 inches is grayish brown loam. The subsoil is about 16 inches thick. It is yellowish brown, friable clay loam in the upper part and light yellowish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In some areas, the soil is calcareous within a depth of 15 inches or the subsoil has more clay.

Typically, the surface layer of the Beckton soil is grayish brown silt loam about 4 inches thick. The subsurface layer is gray silt loam about 2 inches thick. The subsoil is dark grayish brown, firm silty clay about 22 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous silty clay. It has accumulations of carbonate and salts.

Included with these soils in mapping are small areas of Arvada and Hoven soils. These included soils make up less than 10 percent of any one mapped area. Arvada soils are slightly lower on the landscape than the Beckton soil. They have a surface layer that is thinner and lighter colored than that of the Beckton soil. The poorly drained Hoven soils are in depressions.

The content of organic matter is moderate in the Satanta and Beckton soils. Permeability is moderate in the Satanta soil and slow in the Beckton soil. Available water capacity is high in the Satanta soil and moderate in the Beckton soil. Runoff is slow on both soils. The shrink-swell potential is moderate in the subsoil of the Satanta soil and low in the underlying material. It is high in the Beckton soil. The Beckton soil has a content of sodium that adversely affects plant growth.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. The sodium-affected subsoil restricts crop growth in areas of the Beckton soil. Alfalfa, crested wheatgrass, and intermediate wheatgrass are examples of suitable pasture plants. Compaction and moisture conservation are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

These soils are suited to rangeland. Generally, no hazards or limitations affect the use of the Satanta soil for grazing. Compaction is a problem in areas of the Beckton soil. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are suited to windbreaks and environmental plantings. The sodium-affected subsoil restricts root penetration in areas of the Beckton soil. All climatically suited trees and shrubs grow well on the Satanta soil, except for those that require an abundant supply of moisture. Trees and shrubs can be established on the Beckton soil, but optimum growth, survival, and vigor are unlikely.

The Satanta soil is in capability unit IIIc-1, Silty range site, and windbreak suitability group 3. The Beckton soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

SkA—Satanta-Urban land complex, 0 to 2 percent slopes. This map unit consists of a deep, well drained, nearly level Satanta soil and areas of Urban land. It is on back slopes on high terraces. Areas of this map unit are irregular in shape and are 20 to 200 acres in size. They are 45 to 55 percent Satanta soil and 40 to 50 percent Urban land. The Satanta soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Satanta soil is dark grayish brown loam about 6 inches thick. The next 5 inches is grayish brown loam. The subsoil is about 16 inches thick. It is yellowish brown, friable clay loam in the upper part and light yellowish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In some areas, the soil is calcareous within a depth of 15 inches or the subsoil has more clay.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are residential and consist of single family houses and apartments. Some areas are

commercial or industrial sites. Very brief, local flooding can occur in low areas during periods of heavy rainfall.

Included in this unit in mapping are small areas of Beckton soils. These soils make up less than 10 percent of any one mapped area. They are moderately well drained and are on foot slopes. They have a sodium-affected subsoil.

The content of organic matter is moderate in the Satanta soil. Permeability is moderate. Available water capacity is high. Runoff is slow on the Satanta soil and rapid on the Urban land. The shrink-swell potential is moderate in the subsoil of the Satanta soil and low in the underlying material.

The Satanta soil is well suited to lawns, gardens, and recreational development. Lawns, trees, ornamental shrubs, flower gardens, and vegetable gardens generally are successful. Irrigation during droughty periods and regular additions of fertilizer help to achieve optimum growth. In areas where cutting has exposed the subsoil, adding organic matter to the soil and mulching can improve the seedbed.

The Satanta soil generally is suited to building site development and sanitary facilities. The moderate shrink-swell potential is a limitation on building sites. Installing foundation drains, diverting runoff away from the buildings, and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling.

No interpretive groups are assigned to this unit.

SkB—Satanta-Urban land complex, 2 to 6 percent slopes. This map unit consists of a deep, well drained, gently sloping Satanta soil and areas of Urban land. It is on back slopes on high terraces. Areas of this map unit are irregular in shape and are 40 to 300 acres in size. They are 45 to 55 percent Satanta soil and 40 to 50 percent Urban land. The Satanta soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not possible.

Typically, the surface layer of the Satanta soil is dark grayish brown loam about 6 inches thick. The next 5 inches is grayish brown loam. The subsoil is about 16 inches thick. It is yellowish brown, friable clay loam in the upper part and light yellowish brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam. In some areas, the soil is calcareous within a depth of 15 inches or the subsoil has more clay.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are residential and consist of single family houses and apartments. Some areas are commercial or industrial sites. Very brief, local flooding can occur in low areas during periods of heavy rainfall.

Included in this unit in mapping are small areas of Beckton and Zigweid soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Beckton soils are on foot slopes. They have a sodium-affected subsoil. The Zigweid soils are on shoulder slopes. They have less clay in the subsoil than the Satanta soil.

The content of organic matter is moderate in the Satanta soil. Permeability is moderate. Available water capacity is high. Runoff is medium on the Satanta soil and rapid on the Urban land. The shrink-swell potential is moderate in the subsoil of the Satanta soil and low in the underlying material.

The Satanta soil is well suited to lawns, gardens, and recreational development. Lawns, trees, ornamental shrubs, flower gardens, and vegetable gardens generally are successful. Irrigation during droughty periods and regular additions of fertilizer help to achieve optimum growth. In areas where cutting has exposed the subsoil, adding organic matter to the soil and mulching can improve the seedbed.

The Satanta soil generally is suited to building site development and sanitary facilities. The moderate shrink-swell potential is a limitation on building sites. Installing foundation drains, diverting runoff away from the buildings, and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling.

No interpretive groups are assigned to this unit.

SmA—Savo silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on back slopes and the upper foot slopes on plains. Areas are irregular in shape and are 15 to 200 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 38 inches thick. It is dark grayish brown, grayish brown, and pale brown, friable silty clay and silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is brown, calcareous silty clay loam. In some areas the subsoil has more sand.

Included with this soil in mapping are small areas of Beckton and Kyle soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are on the lower foot slopes. Kyle soils are in landscape positions similar to those of the Savo soil. They have more clay than the Savo soil.

The content of organic matter is moderate in the Savo soil. Permeability is moderately slow. Available

water capacity is high. Runoff is slow. The shrink-swell potential is high.

About half of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Leaving crop residue on the surface and minimizing tillage help to conserve moisture.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

SmB—Savo silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on back slopes and the upper foot slopes on plains. Areas are irregular in shape and are 15 to 200 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 38 inches thick. It is dark grayish brown, grayish brown, and pale brown, friable silty clay and silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is brown, calcareous silty clay loam. In some areas the subsoil has more sand.

Included with this soil in mapping are small areas of Beckton and Kyle soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are on the lower foot slopes. Kyle soils are in landscape positions similar to those of the Savo soil. They have more clay than the Savo soil.

The content of organic matter is moderate in the Savo soil, and fertility is medium. Permeability is moderately slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high.

About half of the acreage is used for grazing. No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture and controlling water erosion are important management concerns in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to conserve moisture and control water erosion.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting trees and shrubs on the contour helps to control water erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

SmC—Savo silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on back slopes and the upper foot slopes on dissected plains. Areas are irregular in shape and are 15 to 250 acres in size. Slopes are convex.

Typically, the surface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 38 inches thick. It is dark grayish brown, grayish brown, and pale brown, friable silty clay and silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is brown, calcareous silty clay loam. In some areas the subsoil has more sand.

Included with this soil in mapping are small areas of Beckton, Blackpipe, and Kyle soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained, sodium-affected Beckton soils are on foot slopes. Blackpipe and Kyle soils are in landscape positions similar to those of the Savo soil. Blackpipe soils have shale or mudstone bedrock within a depth of 20 to 40 inches. Kyle soils have more clay than the Savo soil.

The content of organic matter is moderate in the Savo soil. Permeability is moderately slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is used for grazing. Generally, no hazards or limitations affect the use of this soil for rangeland. Water erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

This soil is suited to cultivated crops and to tame pasture and hay, but water erosion is a hazard. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Controlling water erosion and conserving moisture are important management concerns in cultivated areas. Contour farming, minimizing tillage, and including grasses and legumes in the cropping system help to control water erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting trees on the contour helps to control water erosion.

The capability unit is IVe-1; Silty range site; windbreak suitability group 3.

SoB—Savo-Urban land complex, 0 to 9 percent slopes. This map unit consists of a deep, well drained, nearly level to moderately sloping Savo soil and areas of Urban land. It is on dissected plains. Areas of this map unit are irregular in shape and are 20 to 200 acres in size. They are 45 to 55 percent Savo soil and 15 to 25 percent Urban land. The Savo soil and Urban land occur as areas so closely intermingled or so small that mapping them separately is not possible.

Typically, the surface layer of the Savo soil is dark grayish brown silt loam about 4 inches thick. The subsoil is about 38 inches thick. It is dark grayish brown, grayish brown, and pale brown, friable silty clay and silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is brown, calcareous silty clay loam. In some areas the subsoil has more sand.

The Urban land is in areas that have been cut, buried, compacted, or otherwise disturbed and are now covered with streets, buildings, or paved parking lots. Most of the buildings are residential and consist of single family houses and apartments. Some areas are commercial or industrial sites. Very brief, local flooding can occur in low areas during periods of heavy rainfall.

Included in this unit in mapping are small areas of Kyle and Manvel soils. These soils make up less than 10 percent of any one mapped area. Kyle soils are in landscape positions similar to those of the Savo soil. They have more clay than the Savo soil. Manvel soils are on the slightly higher parts of the landscape. They are calcareous throughout and have less clay in the subsoil than the Savo soil.

The content of organic matter is moderate in the Savo soil. Permeability is moderately slow. Available water capacity is high. Runoff is medium on the Savo soil and rapid on the Urban land. The shrink-swell potential is high.

The Savo soil is well suited to lawns, gardens, and recreational development. Lawns, trees, ornamental shrubs, flower gardens, and vegetable gardens generally are successful. Irrigation during droughty periods and regular additions of fertilizer help to achieve optimum growth. In areas where cutting has exposed the subsoil, adding organic matter to the soil and mulching can improve the seedbed.

The Savo soil generally is suited to building site development and sanitary facilities. The high shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation on sites for septic tank absorption fields. Installing foundation drains, diverting runoff away from the buildings, and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

No interpretive groups are assigned to this unit.

StE—Schamber-Samsil complex, 15 to 40 percent slopes. These moderately steep and steep soils are on terraces and dissected plains along river breaks adjacent to the Cheyenne River. The deep, excessively drained Schamber soil is on shoulder slopes. The shallow, well drained Samsil soil is on steep back slopes. Areas of this map unit are long and narrow and are 40 to 200 acres in size. They are 45 to 55 percent Schamber soil and 20 to 30 percent Samsil soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Schamber soil is dark grayish brown gravelly loam about 4 inches thick. The underlying material to a depth of 60 inches is yellowish brown and light yellowish brown, calcareous very gravelly sand. In some areas the soil has more clay.

Typically, the surface layer of the Samsil soil is light brownish gray clay about 2 inches thick. The next 5 inches is light brownish gray, friable clay. The underlying material is light brownish gray and light olive gray clay. It contains about 30 percent, by volume, soft fragments of shale. Light gray, soft shale bedrock is at a depth of about 17 inches. The soil is calcareous throughout. In some areas it is noncalcareous or has less clay.

Included with these soils in mapping are small areas of Altvan, Kyle, Pierre, and Satanta soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. Altvan and Satanta soils are on back slopes. They have more clay and less gravel and sand in the subsoil than the Schamber soil. Altvan soils have gravelly material at a depth of 20 to 40 inches. Kyle and Pierre soils are on the lower back slopes. They have shale bedrock at a depth of more than 20 inches. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support vegetation.

The content of organic matter is low in the Schamber soil and moderately low in the Samsil soil. Permeability is rapid in the Schamber soil and slow in the Samsil soil. Available water capacity is very low in both soils. Runoff is medium on the Schamber soil and rapid on

the Samsil soil. The shrink-swell potential is low in the Schamber soil and very high in the Samsil soil.

All of the acreage is used for grazing. These soils are suited to rangeland. Water erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

These soils are not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope.

The Schamber soil is in capability unit VIIs-7 and Very Shallow range site. The Samsil soil is in capability unit VIIe-5 and Shallow Clay range site. Both soils are in windbreak suitability group 10.

SuE—Shingle loam, 15 to 25 percent slopes. This shallow, well drained, moderately steep soil is on shoulder slopes and the upper back slopes on plains that are dissected by gullies, ravines, and drainageways. Areas are irregular in shape and are 20 to 300 acres in size. Slopes are choppy and convex.

Typically, the surface layer is yellow loam about 3 inches thick. The underlying material is yellow, calcareous loam. It contains 20 percent, by volume, fine, soft fragments of shale. Very pale brown and yellow, soft, interbedded sandy shale and sandstone bedrock is at a depth of about 14 inches. In some areas the soil has more clay.

Included with this soil in mapping are small areas of Cushman and Samsil soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. The moderately deep Cushman soils are on the lower back slopes. Samsil soils are in landscape positions similar to those of the Shingle soil. They have more clay than the Shingle soil. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support grazable vegetation.

The content of organic matter is moderately low in the Shingle soil. Permeability is moderate. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is moderate.

All of the acreage is used for grazing. This soil is suited to rangeland. Water erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming. Sites for stock water impoundments are plentiful, but seepage is a problem.

This soil is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope and a shallow rooting depth.

The capability unit is VIIe-4; Shallow range site; windbreak suitability group 10.

SvF—Shingle-Rock outcrop complex, 25 to 60 percent slopes. This map unit consists of a shallow, well drained, steep and very steep Shingle soil and areas of Rock outcrop. It is on dissected plains. The Shingle soil is on shoulder slopes and the upper back slopes. The Rock outcrop is in very steep areas of rimrock. Areas of this map unit are irregular in shape and are 40 to 500 acres in size. They are 45 to 55 percent Shingle soil and 30 to 40 percent Rock outcrop. The Shingle soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Shingle soil is yellow loam about 3 inches thick. The underlying material is yellow, calcareous loam. It contains 20 percent, by volume, fine, soft fragments of shale. Very pale brown and yellow, soft, interbedded sandy shale and sandstone bedrock is at a depth of about 14 inches. In some areas the soil has more clay.

The Rock outcrop is yellow, soft, interbedded sandstone and shale bedrock. It is on rimrock escarpments. It generally does not support vegetation.

Included in this unit in mapping are small areas of Cushman and Samsil soils. These soils make up less than 15 percent of any one mapped area. The moderately deep Cushman soils are on the lower back slopes. Samsil soils are in landscape positions similar to those of the Shingle soil. They have more clay than the Shingle soil.

The content of organic matter is moderately low in the Shingle soil. Permeability is moderate. Available water capacity is very low. Runoff is rapid. The shrink-swell potential is moderate.

All of the acreage is used for grazing. The Shingle soil is suited to rangeland. Water erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

This map unit is not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the slope and a shallow rooting depth.

The Shingle soil is in capability unit VIIe-4 and Shallow range site. The Rock outcrop is in capability unit VIIIs-2 and is not assigned a range site. The

Shingle soil and the Rock outcrop are both in windbreak suitability group 10.

SzB—Swanboy clay, 0 to 6 percent slopes. This deep, well drained, nearly level to gently sloping soil is on foot slopes on alluvial fans. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 15 to 150 acres in size. Slopes are smooth.

Typically, the surface layer is olive gray clay about 1 inch thick. The subsoil is olive gray, very firm clay about 16 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is olive gray, very firm clay. It has accumulations of carbonate and salts. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Kyle soils and Slickspots. These included soils and Slickspots make up less than 10 percent of any one mapped area. Kyle soils are in landscape positions similar to those of the Swanboy soil. They do not have visible salts within a depth of 10 inches. Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderately low in the Swanboy soil, and fertility is also moderately low. Permeability is very slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is very high.

All of the acreage is used for grazing. This soil is suited to rangeland. The dense clay subsoil and a high content of salts are limitations. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is not suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the dense clay subsoil and the high content of salts near the surface.

The capability unit is VIs-6; Dense Clay range site; windbreak suitability group 10.

TfA—Tilford silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on back slopes on terraces. Areas are irregular in shape and are 20 to 100 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 7 inches thick. The subsoil is reddish brown and light reddish brown, friable, calcareous silt loam about 22 inches thick. It has accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is reddish brown, calcareous loam. It has accumulations of carbonate and salts throughout.

Included with this soil in mapping are small areas of Colombo and Haverson soils. These soils make up less than 10 percent of any one mapped area. They are in the slightly lower landscape positions. They have more sand than the Tilford soil. Haverson soils have a light colored surface layer.

The content of organic matter is moderate in the Tilford soil. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Conserving moisture is an important management concern in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to conserve moisture.

No hazards or limitations affect the use of this soil for rangeland. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

VbD—Valent loamy fine sand, 6 to 25 percent slopes. This deep, excessively drained, gently rolling to hilly soil is on shoulder slopes and the upper back slopes on dissected plains. Areas are irregular in shape and are 40 to 250 acres in size. Slopes are convex. In some areas they have a choppy, dune-like appearance.

Typically, the surface layer is brown loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches is light yellowish brown fine sand. In some areas the soil is calcareous within a depth of 10 inches.

Included with this soil in mapping are small areas of Jayem and Whitelake soils. These soils make up less than 10 percent of any one mapped area. Jayem soils are on the lower back slopes. They have a surface layer that is darker than that of the Valent soil. They have less sand and more clay than the Valent soil. The sodium-affected Whitelake soils are in depressions.

The content of organic matter is low in the Valent soil. Permeability is rapid. Available water capacity is low. Runoff is slow.

All of the acreage is used for grazing. This soil is suited to rangeland. Wind erosion is an important management concern in overgrazed areas. Proper stocking rates and timely deferment of grazing or

rotation grazing help to maintain maximum forage production and control wind erosion.

The Valent soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of droughtiness and the slope.

The capability unit is VIe-7; Sands range site; windbreak suitability group 10.

VbwB—Valent-Wortman loamy fine sands, 2 to 6 percent slopes. These undulating soils are on plains. The deep, excessively drained Valent soil is on back slopes. The moderately deep, well drained, sodium-affected Wortman soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 20 to 150 acres in size. They are 45 to 55 percent Valent soil and 35 to 45 percent Wortman soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Valent soil is brown loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches is light yellowish brown fine sand. In some areas the soil is calcareous at a depth of about 10 inches.

Typically, the surface layer of the Wortman soil is grayish brown loamy fine sand about 9 inches thick. The subsurface layer is light gray fine sandy loam about 4 inches thick. The subsoil is brown, firm clay loam about 9 inches thick. The underlying material is yellowish brown, calcareous clay loam. It has 25 percent, by volume, soft fragments of mudstone. Pale brown, soft mudstone bedrock is at a depth of about 31 inches. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Hisle, Orella, and Wanblee soils and Slickspots. These included soils and Slickspots make up less than 20 percent of any one mapped area. Hisle and Wanblee soils are in landscape positions similar to those of the Wortman soil. They are sodium affected. They have a surface layer that is thinner than that of the Wortman soil. The shallow Orella soils are on shoulder slopes. Slickspots have a puddled surface and are in slightly depressed areas. They do not support vegetation.

The content of organic matter is low in the Valent soil and moderate in the Wortman soil. Permeability is rapid in the Valent soil and very slow in the Wortman soil. Available water capacity is low in both soils. Runoff is slow. The shrink-swell potential is low in the Valent soil and high in the Wortman soil. The Wortman soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. These soils are suited to rangeland. Wind erosion is an important management concern, and sand blowouts are likely to form in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control wind erosion.

These soils are generally not suited to cultivated crops, tame pasture and hay, or windbreaks and environmental plantings because of the sandy surface layer. Droughtiness and the sodium-affected subsoil are limitations.

The Valent soil is in capability unit VIe-7, Sands range site, and windbreak suitability group 10. The Wortman soil is in capability unit IVs-5, Claypan range site, and windbreak suitability group 9.

WaA—Wanblee silt loam, 0 to 4 percent slopes. This moderately deep, sodium-affected, well drained, very gently sloping soil is on the lower back slopes on plains. Areas are irregular in shape and are 30 to 250 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is light brownish gray silt loam about 3 inches thick. The subsoil is about 13 inches thick. It is grayish brown, firm clay in the upper part and light brownish gray, firm, calcareous clay loam in the lower part. It has accumulations of carbonate in the lower part. The underlying material is white, calcareous clay loam. Light gray, soft mudstone bedrock is at a depth of about 29 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Blackpipe, Norrest, Orella, Whitewater, and Wortman soils and Slickspots. These included soils and Slickspots make up less than 10 percent of any one mapped area. Blackpipe, Norrest, Orella, and Whitewater soils are in the slightly higher landscape positions. They do not have a sodium-affected subsoil. Orella soils have bedrock within a depth of 10 to 20 inches. Wortman soils are in landscape positions similar to those of the Wanblee soil. They have a surface layer that is thicker and darker than that of the Wanblee soil. Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderate in the Wanblee soil. Permeability is very slow. Available water capacity is low. Runoff is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material. This soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is generally unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense, sodium-affected subsoil restricts root penetration.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

WbB—Wanblee-Wortman silt loams, 0 to 4 percent slopes. These moderately deep, sodium-affected, well drained, very gently sloping soils are on plains. The Wanblee soil is on the upper back slopes. The Wortman soil is on the lower back slopes. Areas of this map unit are irregular in shape and are 20 to 350 acres in size. They are 50 to 60 percent Wanblee soil and 30 to 40 percent Wortman soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Wanblee soil is light brownish gray silt loam about 3 inches thick. The subsoil is about 13 inches thick. It is grayish brown, firm clay in the upper part and light brownish gray, firm, calcareous clay loam in the lower part. It has accumulations of carbonate in the lower part. The underlying material is white, calcareous clay loam. Light gray, soft mudstone bedrock is at a depth of about 29 inches. In some areas the depth to bedrock is more than 40 inches. In townships 1, 2, and 3 north and in ranges 15, 16, and 17 east, the surface layer and subsoil are darker.

Typically, the surface layer of the Wortman soil is grayish brown silt loam about 5 inches thick. The subsoil is about 29 inches thick. It is dark grayish brown silty clay in the upper part; grayish brown, calcareous silty clay in the next part; and light brownish gray, calcareous silty clay loam in the lower part. Light gray, soft mudstone bedrock is at a depth of about 34 inches. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Blackpipe and Norrest soils and Slickspots. These included soils and Slickspots make up less than 15 percent of any one mapped area. Blackpipe and Norrest soils are on the slightly higher, convex parts of the landscape. They do not have a sodium-affected subsoil. Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderate in the Wanblee and Wortman soils. Permeability is very slow in both soils. Available water capacity is low. Runoff is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material. These soils have a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

The Wanblee soil is unsuited to cultivated crops and to tame pasture and hay because of the dense, sodium-affected subsoil. The Wortman soil is suited to cultivated crops and to tame pasture and hay, but the sodium-affected subsoil restricts crop growth. Alfalfa, crested wheatgrass, and western wheatgrass are examples of suitable pasture plants. Compaction and moisture conservation are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

The Wanblee soil is unsuited to windbreaks and environmental plantings because of the dense, sodium-affected subsoil. The Wortman soil is suited to windbreaks and environmental plantings, but the sodium-affected subsoil restricts root penetration. Trees and shrubs can be established, but optimum growth, survival, and vigor are unlikely.

The Wanblee soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10. The Wortman soil is in capability unit IVs-5, Claypan range site, and windbreak suitability group 9.

WeA—Weta silt loam, 0 to 3 percent slopes. This deep, well drained, sodium-affected, nearly level soil is on foot slopes on alluvial fans. Areas are irregular in shape and are 30 to 200 acres in size.

Typically, the surface layer is light brownish gray silt loam about 3 inches thick. The subsoil is about 18 inches thick. It is dark grayish brown, very firm clay in the upper part and brown, firm silty clay loam in the lower part. It has accumulations of salts and carbonate in the lower part. The underlying material to a depth of 60 inches is pale brown and light gray, stratified, calcareous silty clay loam, silt loam, and loam. In some areas the subsoil contains less sodium.

Included with this soil in mapping are small areas of Cactusflat and Norka soils and Slickspots. These included soils and Slickspots make up less than 15 percent of any one mapped area. Cactusflat soils are in landscape positions similar to those of the Weta soil. Norka soils are on the slightly higher parts of the landscape. Cactusflat and Norka soils do not have a sodium-affected subsoil. Slickspots are in slightly depressed areas and have a puddled surface. They do not support vegetation.

The content of organic matter is moderate in the Weta soil, and fertility is low. Permeability is slow in the

subsoil and moderately slow in the underlying material. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material. This soil has a sodium-affected subsoil that adversely affects plant growth.

All of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is generally unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense, sodium-affected subsoil and a high content of salts in the subsoil are limitations.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

Wh—Whitelake fine sandy loam. This deep, moderately well drained, sodium-affected, nearly level soil is in closed depressions on plains. Areas are irregular in shape and are 20 to 80 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is grayish brown fine sandy loam about 7 inches thick. The subsurface layer is light brownish gray loamy fine sand about 3 inches thick. The subsoil is about 17 inches thick. It is light brownish gray, brown, and grayish brown, firm, calcareous sandy clay loam. It has accumulations of carbonate and salts in the lower part. The underlying material to a depth of 60 inches is very pale brown and brownish yellow, calcareous very fine sandy loam and loamy fine sand.

Included with this soil in mapping are small areas of Jayem and Valent soils. These soils make up less than 15 percent of any one mapped area. They are on back slopes. They do not have a sodium-affected subsoil.

The content of organic matter is moderately low in the Whitelake soil. Permeability is slow in the subsoil and moderate in the underlying material. Available water capacity is moderate. Runoff is slow. This soil has a sodium-affected subsoil that adversely affects plant growth. A seasonal high water table is at a depth of 2 to 4 feet.

All of the acreage is used for grazing. This soil is suited to rangeland. Wind erosion is an important management concern in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production and control wind erosion.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Controlling wind erosion and conserving moisture are important management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control wind erosion and conserve moisture.

This soil is suited to windbreaks and environmental plantings. Droughtiness is a limitation. Most climatically suited trees and shrubs grow well. Fallowing the site prior to spring planting helps to establish new trees and shrubs.

The capability unit is IVe-12; Sandy range site; windbreak suitability group 5.

WkA—Whitewater clay, 0 to 3 percent slopes. This moderately deep, well drained, nearly level soil is on back slopes on plains. When dry, it is characterized by cracks 0.5 to 1.0 inch wide and several feet long that extend through the subsoil. Areas are irregular in shape and are 20 to 300 acres in size.

Typically, the surface layer is gray clay about 3 inches thick. The subsoil is gray, very firm clay about 23 inches thick. The underlying material is light gray clay. Pinkish gray, soft mudstone bedrock is at a depth of about 33 inches. The soil is calcareous throughout. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Cedarpass, Interior, Larvie, and Orella soils. These soils make up less than 10 percent of any one mapped area. Cedarpass soils are on summits. They have a surface layer that is darker than that of the Whitewater soil and have less clay. Interior soils are on high flood plains. They are stratified and have less clay than the Whitewater soil. Larvie soils are in landscape positions similar to those of the Whitewater soil. They have red hue in the C horizon. Orella soils are in the slightly higher landscape positions and are 10 to 20 inches deep over shale bedrock.

The content of organic matter is moderately low in the Whitewater soil. Permeability is very slow. Available water capacity is very low. Runoff is slow. The shrink-swell potential is very high. This soil has a high content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. This soil is suited to rangeland. The dense clay subsoil and the high content of sodium are limitations. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the dense clay subsoil and the high content of sodium.

The capability unit is VIs-6; Dense Clay range site; windbreak suitability group 10.

WoB—Whitewater-Orella clays, 3 to 9 percent slopes. These well drained, gently sloping and moderately sloping soils are on plains. The moderately deep Whitewater soil is on back slopes. The shallow Orella soil is on shoulder slopes and convex summits. Areas of this map unit are irregular in shape and are 20 to 200 acres in size. They are 45 to 55 percent Whitewater soil and 30 to 40 percent Orella soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Whitewater soil is gray clay about 3 inches thick. The subsoil is gray, very firm clay about 23 inches thick. The underlying material is light gray clay. Pinkish gray, soft mudstone bedrock is at a depth of about 33 inches. The soil is calcareous throughout. In some areas the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Orella soil is grayish brown clay about 3 inches thick. The next 5 inches is light gray, firm clay. It contains about 15 percent, by volume, soft fragments of mudstone. The underlying material is light gray clay. It contains about 45 percent, by volume, soft fragments of mudstone. White and pale yellow, soft mudstone bedrock is at a depth of about 14 inches. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Denby, Interior, and Larvie soils and Rock outcrop. These included soils and Rock outcrop make up less than 15 percent of any one mapped area. The deep Denby soils are on summits on terraces. The deep Interior soils are on foot slopes on alluvial fans. They have less clay than the Whitewater soil. They are stratified. Larvie soils are in landscape positions similar to those of the Whitewater soil. They have red hue in the C horizon. The Rock outcrop occurs in a random pattern throughout the mapped areas. It does not support vegetation.

The content of organic matter is low in the Orella soil and moderately low in the Whitewater soil. Permeability is very slow in both soils. Available water capacity is very low. Runoff is medium. The shrink-swell potential is very high in the Whitewater soil and high in the Orella soil. These soils have a high content of sodium that adversely affects the growth of most plants.

All of the acreage is used for grazing. These soils are suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

These soils are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the high content of sodium and the dense clay subsoil.

The Whitewater soil is in capability unit VIe-4 and Dense Clay range site. The Orella soil is in capability unit VIIe-5 and Shallow Clay range site. Both soils are in windbreak suitability group 10.

WwB—Wortman silt loam, 0 to 6 percent slopes. This moderately deep, well drained, sodium-affected, nearly level to gently sloping soil is on foot slopes on plains. Areas are irregular in shape and are 10 to 120 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 29 inches thick. It is dark grayish brown silty clay in the upper part; grayish brown, calcareous silty clay in the next part; and light brownish gray, calcareous silty clay loam in the lower part. Light gray, soft mudstone bedrock is at a depth of about 34 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Blackpipe, Norrest, and Wanblee soils. These soils make up less than 15 percent of any one mapped area. Blackpipe and Norrest soils are on the convex, slightly higher parts of the landscape. They do not have a sodium-affected subsoil. Wanblee soils are in landscape positions similar to those of the Wortman soil. They have a thin, light colored surface layer.

The content of organic matter is moderate in the Wortman soil. Permeability is very slow. Available water capacity is low. Runoff is medium. The shrink-swell potential is high in the subsoil and moderate in the underlying material. This soil has a sodium-affected subsoil that adversely affects plant growth.

Most of the acreage is used for grazing. This soil is suited to rangeland. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production.

This soil is suited to cultivated crops and to tame pasture and hay, but the sodium-affected subsoil restricts crop growth. Alfalfa, crested wheatgrass, and western wheatgrass are examples of suitable pasture plants. Compaction and moisture conservation are important management concerns in cultivated areas.

Minimizing tillage, leaving crop residue on the surface, and subsoiling or deep chiseling help to conserve moisture and prevent compaction.

This soil is suited to windbreaks and environmental plantings. The sodium-affected subsoil restricts root penetration. Trees and shrubs can be established, but optimum growth, survival, and vigor are unlikely.

The capability unit is IVs-5; Claypan range site; windbreak suitability group 9.

ZnD—Zigweid-Nihill complex, 6 to 15 percent slopes. These deep, moderately sloping and strongly sloping soils are on high terraces. The well drained Zigweid soil is on back slopes. The excessively drained Nihill soil is on shoulder slopes. Areas of this map unit are irregular in shape and are 40 to 250 acres in size. They are about 45 to 55 percent Zigweid soil and 25 to 35 percent Nihill soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Zigweid soil is dark grayish brown loam about 4 inches thick. The subsoil is brown and pale brown, friable loam about 12 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam.

Typically, the surface layer of the Nihill soil is brown gravelly loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray very gravelly loam. The soil is calcareous throughout, and carbonate coatings are on the underside of pebbles.

Included with these soils in mapping are small areas of Nunn, Satanta, and Pierre soils. These included soils make up less than 15 percent of any one mapped area. Nunn and Satanta soils are on back slopes. Nunn soils have more clay in the subsoil than the Zigweid and Nihill soils. Satanta soils have a surface layer that is thicker and darker than that of the Zigweid and Nihill soils. Pierre soils are on low back slopes. They have more clay throughout than the Zigweid and Nihill soils. They have shale bedrock at a depth of 20 to 40 inches.

The content of organic matter is moderately low in the Zigweid soil and low in the Nihill soil. Permeability is moderate in the Zigweid soil and moderately rapid in the Nihill soil. Available water capacity is high in the Zigweid soil and low in the Nihill soil. Runoff is medium on both soils. The shrink-swell potential is moderate in the Zigweid soil and low in the Nihill soil.

All of the acreage is used for grazing. These soils are suited to rangeland. Water erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum forage production. Gullies can form along livestock trails. Controlling livestock traffic patterns helps to keep gullies from forming.

These soils are not suited to cultivated crops. The Nihill soil is not suited to tame pasture and hay or to windbreaks and environmental plantings because of the slope, the droughtiness, and the shallowness to gravelly material. The Zigweid soil is suited to tame pasture and hay and to windbreaks and environmental plantings. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The Zigweid soil is in capability unit VIe-1, Thin Upland range site, and windbreak suitability group 8. The Nihill soil is in capability unit IVs-4, Very Shallow range site, and windbreak suitability group 10.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and help to prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of the survey.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay or pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

The soils in the survey area have good potential for increased crop production. Crop production could be increased considerably by extending the latest technology for crop production to all cropland in the area. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the management needed on the cropland in the survey area.

Water erosion reduces productivity and results in sedimentation. It is a hazard on Nunn, Ottumwa, Satanta, and other soils if the slope is more than 2 percent. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Cushman, Kyle, Pierre, and Wortman soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Jayem soils. When erosion occurs, sediment rich in nutrients enters streams, lakes, and reservoirs. Measures that control erosion minimize this pollution and preserve water quality for fish and other wildlife and for recreational uses. They also reduce the amount of fertilizer needed in cropped areas by helping to prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soil. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion. Conservation tillage is a form of noninversion tillage that retains protective amounts of crop residue on the surface throughout the year. It is effective in reducing the hazards of wind erosion and water erosion. It includes no-till, strip-till, stubble mulching, and chemical fallow systems that provide a minimum number of tillage operations. Stubble left standing throughout the winter traps and holds snow and thus increases the moisture supply.

Terraces and diversions help to control erosion by reducing the runoff rate and the length of slopes. They are most practical on deep, well drained soils that have long, smooth slopes. Many of the soils in the survey area are poorly suited to terraces and diversions because they have short, irregular slopes or have an unfavorable subsoil, which would be exposed in terrace channels. Grassed waterways are effective in controlling gully erosion.

Wind erosion is a slight to severe hazard on many of the soils in the survey area. It is especially severe on soils that have a surface layer of fine sandy loam, such as Jayem soils. Soils that have a high content of clay in the surface layer, such as Kyle, Ottumwa, and Pierre soils, also are susceptible to wind erosion. Wind erosion can damage these soils in a few hours if winds are strong and if the soils are dry and are not protected by a plant cover or surface mulch. It can be controlled by an adequate plant cover, a cover of crop residue, stripcropping, and tillage methods that keep the surface rough. Establishing windbreaks of suitable trees and shrubs and leaving strips of unharvested crops also are effective in controlling wind erosion.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, available in the local office of the Natural Resources Conservation Service.

Soil fertility helps to determine the yields that can be obtained from the soil. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The kind and amount of fertilizer needed on soils that have a high content of lime in the surface layer, such as Baca soils, generally differ from the kind and amount needed on soils that do not have lime in the surface layer. On all soils, additions of fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kind and amount of fertilizer needed.

Field crops suited to the soils and climate of the survey area include small grain and row crops. Winter wheat and oats are the main small grain crops. Grain sorghum is the main row crop. Corn is grown for silage on a small acreage.

The deep, well drained soils are suited to all of the crops commonly grown in the survey area. Examples are Nunn, Ottumwa, and Satanta soils. Soils such as Blackpipe and Cushman soils are better suited to early maturing small grain than to the deeper-rooted crops, such as sorghum and alfalfa, because they have a low available water capacity. The erosive Jayem soils also are better suited to small grain crops, which can provide better protection against wind erosion than row crops. None of the map units in this soil survey meets the requirements for prime farmland.

Pasture plants best suited to the climate and most of the soils in the survey area include alfalfa, crested wheatgrass, and intermediate wheatgrass. Because of the hazard of erosion, bunch grasses, such as crested wheatgrass, should not be planted in areas where the slope is more than 6 percent. On the poorly drained Hoven soils, western wheatgrass is the best suited species but other desirable species include Garrison creeping foxtail and reed canarygrass. Pubescent wheatgrass is suited to Wortman soils and other soils that have a claypan subsoil.

If the pasture is overgrazed, the grasses lose vigor and die and they usually are replaced by annual grasses and by weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition.

Each soil in the survey area has been assigned a pasture group. These groups are listed in the section "Interpretive Groups," which follows the tables at the back of the survey.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper

planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(9)*. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1 and IVe-2.

The capability classification of each map unit is given under the heading "Detailed Soil Map Units" and in the section "Interpretive Groups."

Rangeland

Rod Baumberger, range conservationist, Natural Resources Conservation Service, helped prepare this section.

Range is land on which the native vegetation consists mainly of grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes areas where the native vegetation has been reestablished. The amount and kind of native vegetation grown in any one area are determined by the soil, topography, climate, past use, and management.

All of the survey area was range before the first permanent settlers arrived. About 80 percent of the survey area currently supports native vegetation. Range

supplies a major portion of the forage for livestock in the survey area.

Approximately 80 percent of the farm and ranch income in the survey area is derived from the sale of livestock. Most of the ranches are cow-calf enterprises, but some are yearling enterprises. Also, some ranches include both cow herds and yearlings. The range generally is grazed throughout the year. In winter, protein concentrates and hay generally supplement the forage provided by range. Tame pasture plants, such as crested wheatgrass and intermediate wheatgrass, also supplement this forage.

The survey area is part of the mixed-grass prairie. The native vegetation is dominated by mid and short grasses and by forbs. Some tall grasses are interspersed with these plants. The mixed-grass prairie consists of cool- and warm-season plants that provide good-quality forage throughout the growing season. Most of the growth of the cool-season plants occurs from April through June. Most of the growth of the warm-season plants occurs from June through August. The cool-season grasses may start growing again in September and October if soil moisture is adequate.

The Badlands, in the southern part of the survey area, are characterized by very steep areas of Rock outcrop. Stands of Rocky Mountain juniper grow in scattered areas where some soil formation has occurred.

The production of native vegetation in some parts of the survey area is below potential because of past misuse. Many of the tall grasses and some of the mid grasses have been replaced by short grasses. As a result, the total amount of available forage has been reduced. In most areas, however, the original high-quality plants can be reestablished under good grazing management.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce native vegetation. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table also are important. Soils that produce approximately the same kinds, amounts, and proportions of native vegetation make up a range site. The potential native vegetation on a range site is the stabilized plant community that the site is capable of producing. It consists of the plants that were growing on the site when the region was settled. The plant community maintains itself and changes very little as long as the environment remains unchanged. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map.

The plants within the native plant community are sometimes grouped as decreasers, increasers, or invaders, depending on their response to grazing pressure. *Decreasers* are plants that respond to overgrazing by decreasing in abundance. They generally are the most productive plants and the ones most preferred by the grazing animals. *Increasers* are plants that respond to grazing pressure, at least initially, by increasing in amount as the more desirable decreaser plants become less abundant. Increasers generally are less productive and less preferred by grazing animals. *Invaders* are plants that are not part of the original plant community but invade because of some kind of disturbance or continued overgrazing. Some invaders have little or no value as forage plants. Because plants do not respond in the same manner to different influences, a plant may be a decreaser on some range sites but an increaser on others.

Table 6 shows, for nearly all soils, the range site and the total annual production of vegetation in favorable, average, and unfavorable years. *Potential annual production* is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management helps to maintain forage production and provides wildlife habitat, water, and watershed protection. The primary objective of good range management is to keep the range in excellent or good condition. The main management concern is responding to important changes in the plant community on a range site.

Range condition is ascertained by comparing the present vegetation on a range site with the potential native plant community for that site. Four range condition classes are recognized. The range site is in

excellent condition if 76 to 100 percent of the present vegetation is the same kind as the potential native vegetation, in *good* condition if the percentage is 51 to 75, in *fair* condition if the percentage is 26 to 50, and in *poor* condition if the percentage is 25 or less. The potential productivity of rangeland depends on the range site, the range condition, and the amount of moisture available to plants during the growing season.

Measures that maintain or improve the range condition are needed on all of the range in the survey area. These include proper stocking rates and a rotation grazing or deferred grazing program in which the proper sequence of grazing and rest periods helps to maintain or improve the vigor of the key plants. Other measures are range seeding, fencing, watering facilities, and mechanical treatment.

The range site of each map unit also is given under the heading "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables at the back of this survey.

A total of 17 range sites are recognized in the survey area. They are Badland Overflow, Clayey, Clayey Overflow, Claypan, Closed Depression, Dense Clay, Loamy Overflow, Loamy Terrace, Saline Lowland, Sands, Sandy, Shallow, Shallow Clay, Silty, Thin Claypan, Thin Upland, and Very Shallow. The paragraphs that follow describe these range sites.

Badland Overflow range site. The potential native vegetation on this site is an excellent stand of mid and short grasses. Warm-season grasses make up about 55 percent of the vegetation, and cool-season grasses make up about 40 percent. Sideoats grama, little bluestem, buffalograss, and blue grama are the main warm-season grasses. The cool-season grasses are mainly western wheatgrass and lesser amounts of green needlegrass and needleandthread. The vegetation on this site varies according to the frequency and extent of soil deposition by floodwater.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed or flooding occurs, western wheatgrass, little bluestem, and sideoats grama decrease in abundance, broom snakeweed, blue grama, and weeds increase in abundance, and bare areas increase in extent. Threeawn and cocklebur are common invaders. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Clayey range site. The potential native vegetation on this site is mid and short prairie grasses interspersed with a variety of forbs and shrubs. Green needlegrass and western wheatgrass make up about 65 percent of the vegetation. Warm-season grasses make up about 25 percent. They include blue grama, sideoats grama, buffalograss, little bluestem, and big bluestem. Forbs, such as American vetch, scurfpea, and yarrow, make up the rest of the vegetation.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, green needlegrass and western wheatgrass lose their productive capacity because the livestock prefer these plants. If overgrazing continues, western wheatgrass and green needlegrass decrease in abundance and are replaced by buffalograss and blue grama. The extent of the most productive grasses can be maintained by proper stocking rates. Other management includes rotation or deferred grazing. Mechanical treatment is needed in some areas.

Clayey Overflow range site. The potential native vegetation on this site is mid and tall grasses. Cool-season grasses make up about 90 percent of the vegetation. They are mainly western wheatgrass and lesser amounts of green needlegrass. Short grasses, such as buffalograss and blue grama, are in the understory. Forbs and woody species are not of major importance when this site is in excellent condition.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, western wheatgrass decreases in abundance and is replaced by buffalograss, blue grama, and weeds. Japanese brome and cocklebur are common invaders. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Western wheatgrass, the dominant cool-season grass, makes up about 40 percent of the vegetation. Needleandthread and green needlegrass make up about 15 percent. Warm-season grasses, such as blue grama, buffalograss, prairie sandreed, and sideoats grama, make up about 35 percent. Silver sagebrush, pricklypear, and forbs, such as sagewort, broom snakeweed, and American vetch, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, western wheatgrass, green needlegrass, prairie sandreed, and sideoats grama decrease in abundance and blue grama, buffalograss, and forbs increase. The result is low forage production. If overgrazing continues, a considerable extent of the surface remains bare, especially during droughty

periods. The extent of the most productive grasses can be maintained by proper stocking rates in combination with a rotation or deferred grazing program that provides rest periods during the key growing seasons of these plants.

Closed Depression range site. The potential native vegetation on this site is mid grasses. Western wheatgrass makes up about 85 percent of the vegetation. Kentucky bluegrass, sedges, rushes, and inland saltgrass make up the rest. In the wetter areas, the amount of western wheatgrass is lower and the amount of rushes, sedges, and inland saltgrass is higher.

The major management concern on this site is maintaining the extent of western wheatgrass. If the site is overgrazed, this grass decreases in abundance and is replaced by rushes and weeds. The extent of western wheatgrass can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Dense Clay range site. The potential native vegetation on this site is mid prairie grasses interspersed with forbs. Western wheatgrass makes up about 70 percent of the vegetation. Green needlegrass, another cool-season grass, makes up about 20 percent. Forbs, such as wild onion and American vetch, make up about 10 percent. This site usually does not have an understory of short grasses.

The major management concern on this site is maintaining the extent of green needlegrass and western wheatgrass. If the site is overgrazed, these grasses decrease in abundance and are replaced by unpalatable plants or the surface remains bare. Erosion is a serious hazard in bare areas. The extent of green needlegrass and western wheatgrass can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Loamy Overflow range site. The potential native vegetation on this site is mid and tall grasses. Cool-season grasses make up about 70 percent of the vegetation. They are mainly western wheatgrass, green needlegrass, and lesser amounts of needleandthread. Warm-season grasses, such as prairie sandreed, little bluestem, and blue grama, make up about 20 percent of the vegetation. The remaining vegetation consists of forbs, leadplant, and sedges.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, western wheatgrass and green needlegrass decrease in abundance and needleandthread and blue grama increase. If overgrazing continues, Kentucky bluegrass, a short, cool-season grass, increases in abundance and becomes dominant. The result is low forage production. The extent of the most productive grasses can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Loamy Terrace range site. The potential native vegetation on this site is mixed prairie grasses. Western wheatgrass and green needlegrass, the major cool-season grasses, make up about 70 percent of the vegetation. Needleandthread makes up about 10 percent. Warm-season grasses, such as big bluestem, prairie sandreed, blue grama, and buffalograss, make up about 25 percent. The remaining vegetation consists of sedges, sagewort, rose, big sagebrush, and silver sagebrush. Scattered cottonwoods and shrubs provide protection for livestock. They also provide wildlife habitat.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, western wheatgrass, green needlegrass, big bluestem, and prairie sandreed decrease in abundance and buffalograss, blue grama, forbs, and woody plants increase. The extent of the most productive grasses can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Saline Lowland range site. The potential native vegetation on this site is salt-tolerant grasses. Western wheatgrass and Nuttall alkaligrass make up about 80 percent of the vegetation. Inland saltgrass and foxtail barley make up about 15 percent. Sedges and forbs make up the rest. In some areas prairie cordgrass and alkali cordgrass make up as much as 60 percent of the vegetation.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, western wheatgrass and Nuttall alkaligrass decrease in abundance and inland saltgrass and foxtail barley become the principal grasses. The extent of the most productive grasses can be maintained by proper stocking rates and by rotation grazing or deferred grazing.

Sands range site. The potential native vegetation on this site is mainly warm-season, tall and mid grasses. These grasses make up about 80 percent of the vegetation. Little bluestem makes up about 20 percent; sand bluestem and big bluestem, 30 percent; prairie sandreed, 20 percent; sand dropseed, 5 percent; and an understory of blue grama and sedges, 5 percent. Needleandthread and western wheatgrass make up

about 10 percent of the vegetation. Forbs and woody plants, such as leadplant, rose, and sandcherry, also make up about 10 percent. In areas of Bankard Variant soils, the vegetation is primarily cottonwoods, willows, and annual plants.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, bluestems and prairie sandreed decrease in abundance and are replaced by sand dropseed and blue grama. If overgrazing continues, green sagewort and sandbur increase in abundance and bare areas increase in extent. Wind erosion is a serious hazard in bare areas. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Sandy range site. The potential native vegetation on this site is mixed prairie grasses, chiefly mid and tall grasses. The principal warm-season grasses are little bluestem, sand bluestem, big bluestem, blue grama, and prairie sandreed. They make up about 55 percent of the vegetation. Needleandthread and western wheatgrass make up about 30 percent. The remaining vegetation is scurfpea, sagewort, and other forbs.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, bluestems and prairie sandreed decrease in abundance and are replaced by needleandthread and western wheatgrass. If overgrazing continues, these cool-season grasses decrease in abundance and are replaced by sand dropseed, threadleaf sedge, blue grama, and pricklypear. Under these conditions, sagewort commonly increases in abundance. The result is low forage production. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Shallow range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses make up about 70 percent of the vegetation. Little bluestem makes up about 40 percent; sideoats grama, 20 percent; big bluestem, 5 percent; and blue grama and prairie sandreed, 5 percent. Cool-season grasses, such as needleandthread and western wheatgrass, make up about 15 percent of the vegetation. Other plants, such as sedges, forbs, and shrubs, also make up about 15 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, little bluestem and big bluestem decrease in abundance and needleandthread and sideoats grama increase. If overgrazing continues, sideoats grama and needleandthread decrease in abundance. The result is a sparse stand of sedges, blue grama, and weedy forbs. The extent of the most productive grasses can be maintained by proper stocking rates in combination with rotation grazing or timely deferment of grazing.

Shallow Clay range site. The potential native vegetation on this site is mixed warm- and cool-season prairie grasses. Western wheatgrass and green needlegrass make up about 45 percent of the vegetation. Warm-season grasses, such as sideoats grama, little bluestem, and blue grama, make up about 45 percent. Forbs, such as scurfpea, sagewort, and blacksamson, make up about 5 percent. Shrubs, particularly skunkbush sumac, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, needlegrass and little bluestem decrease in abundance because the livestock prefer these plants. If overgrazing continues, western wheatgrass and sideoats grama decrease in abundance and blue grama and unpalatable forbs increase. The extent of the most productive plants can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Silty range site. The potential native vegetation on this site is mixed prairie grasses. Cool-season grasses make up about 65 percent of the vegetation. Green needlegrass, western wheatgrass, and needleandthread are the major grasses. Warm-season grasses, such as sideoats grama, little bluestem, prairie sandreed, buffalograss, and blue grama, make up about 25 percent of the vegetation. Shrubs and forbs, such as sagewort, heath aster, yarrow, and Missouri goldenrod, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, western wheatgrass, green needlegrass, and needleandthread decrease in abundance and are replaced by buffalograss, blue grama, sagewort, and threadleaf sedge. The result is low forage production. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Thin Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Short, warm-season grasses dominate the site. Blue grama makes up about 40 percent of the vegetation, and buffalograss makes up about 15

percent. Needleandthread and mid, cool-season grasses, such as western wheatgrass, make up about 30 percent. Pricklypear, sagebrush, and forbs, such as sagewort and broom snakeweed, make up the rest.

The major management concern on this site is maintaining the extent of western wheatgrass and needleandthread. If the site is overgrazed, these grasses decrease in abundance and are replaced by blue grama, buffalograss, and inland saltgrass. If overgrazing continues, a considerable extent of the surface remains bare, especially during dry periods. Weeds increase in abundance during wet periods. The extent of the desirable grasses can be maintained or increased by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Thin Upland range site. The potential native vegetation on this site is mixed prairie grasses. Cool-season grasses, such as needleandthread, make up about 30 percent of the vegetation. Warm-season grasses, such as prairie sandreed, sideoats grama, and little bluestem, make up about 30 percent. Blue grama and threadleaf sedge, the major understory plants, make up about 30 percent. Woody plants and forbs, such as sagewort, make up the rest.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, needleandthread, western wheatgrass, and little bluestem decrease in abundance. If overgrazing continues, sedges and blue grama dominate the site. The result is low forage production. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Very Shallow range site. The potential native vegetation on this site is sparse stands of mid and short grasses. Needleandthread and little bluestem are the dominant mid grasses and make up about 45 percent of the vegetation. Short grasses, such as sideoats grama and bluegrasses, make up about 20 percent. Sedges, such as threadleaf sedge, make up about 20 percent. Forbs, such as dotted gayfeather and sagewort, and shrubs, such as small soapweed and pricklypear, make up the rest.

The main management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, it rapidly deteriorates to a stand of grama grasses, threadleaf sedge, and a few unpalatable forbs. If overgrazing continues, the short grasses decrease in abundance and much of the site becomes bare and subject to erosion. The most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Native Woodland, Windbreaks, and Environmental Plantings

Sheridan I. Dronen, forester, Natural Resources Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 5,000 acres in the survey area, generally on the flood plains adjacent to the Cheyenne and White Rivers and along small creeks and drainageways. The early settlers used the native trees and shrubs for fuel and food. Currently, most of the wooded areas are used for livestock protection in winter and for wildlife habitat.

Cottonwoods are the dominant species in areas of Bankard and Glenberg soils and in oxbows on the flood plains. Sandbar willow grows in low areas adjacent to the Cheyenne and White Rivers. On the flood plains along these rivers, many areas of Haverson soils support cottonwood, green ash, American elm, and chokecherry. Some of these areas have been cleared and are used for cultivated crops or alfalfa.

The creeks in the western part of the survey area flow out of the Black Hills. Cottonwood, green ash, American plum, boxelder, chokecherry, peachleaf willow, buffaloberry, snowberry, and rose grow near the channels of these creeks in areas of Colombo and Haverson soils.

The creeks that empty into the White River drain areas of Badland. Interior soils are the main soils along the drainageways. Scattered clumps of cottonwood, green ash, American plum, snowberry, and rose grow near the channels of these creeks in areas of Interior soils.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect gardens and furnish habitat for wildlife. Several rows of broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various

soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

Fallowing a year before planting helps to provide a reserve supply of the moisture necessary for the establishment of seedlings. Complete weed control is needed to establish and maintain a good windbreak. Cultivation and applications of herbicide help to control weeds. Grazing is extremely damaging to windbreaks because it results in soil compaction and the loss of the lower branches of the trees and shrubs. Removal of the lower branches reduces the effectiveness of the windbreaks.

At the end of each map unit description under the heading "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables at the back of this survey, the soil has been assigned a windbreak suitability group. These groups are based primarily on suitability of the soil for the locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak suitability group in the survey area are provided in the Technical Guide, which is available in the local office of the Natural Resources Conservation Service.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Connie M. Vicuna, biologist, Natural Resources Conservation Service, prepared this section.

Most of the survey area is used as range. Rangeland wildlife species provide excellent outdoor recreational opportunities. About 24 percent of the survey area is in the Buffalo Gap National Grasslands and the Badlands National Park. Wildlife habitats in areas of range and in

the Badlands maintain much of their original character. Consequently, many of the original wildlife species still inhabit the survey area, though in less abundance. These species include antelope, mule deer, sharptail grouse, jackrabbit, and prairie dogs. Populations of bighorn sheep and buffalo are maintained in the Badlands National Park. Bird life is diverse in areas where eastern and western bird communities overlap. Common predators include coyote, fox, badger, raccoon, skunks, golden eagles, hawks, bobcats, and rattlesnakes. Swift fox and the endangered black-footed ferret have also been sighted. White-tailed deer, gray partridge, and ring-necked pheasant have benefited from agricultural influences in the survey area.

Woody habitat is available primarily on bottom land along the Cheyenne River, the White River, Rapid Creek, and Spring Creek. In the smaller drainageways and in some draws, small islands or corridors of woody cover also are available. Although not abundant, these scattered shrubby and woody areas are very important for many wildlife species, either for food or as cover during some part of the year.

Wetland habitat includes small areas along drainageways and some shallow basins. Stock water dams also provide some wetland habitat. Waterfowl generally are abundant only during migration periods, although small populations of breeding ducks and geese inhabit areas around stock water dams that have adequate cover.

Fishing opportunities are available primarily along the Cheyenne River, the White River, Rapid Creek, and Spring Creek. Some livestock dams have been stocked for public fishing.

Because of similarities in topography and in the ability to produce and maintain distinct plant communities, soil associations provide some indication of actual and potential distribution and density of wildlife and their habitat. Land use and management have a primary influence on wildlife and often correlate with soil associations. The sixteen soil associations in the survey area are described under the heading "General Soil Maps Units."

Antelope are throughout the survey area on rolling to steep, open terrain in the Nunn-Satanta, Blackpipe-Norrest-Wortman, Orella-Hisle-Whitewater, Orella-Fairburn-Badland, Cushman-Shingle, and Ottumwa-Razor associations. Mule deer also are throughout the survey area where steep slopes are cut by draws. This habitat is common in the Samsil-Pierre and Orella-Fairburn-Badland associations. White-tailed deer frequent wooded bottom land and cropland. They are most common in the Bankard-Haverson-Lohmiller and Owanka-Haverson-Colombo associations. A combination of cropland and wetland that occurs in the Blackpipe-Wortman association also provides good habitat for white-tailed deer.

Pheasants and gray partridge are common in the more heavily cropped areas of the Nunn-Satanta, Blackpipe-Wortman, and Owanka-Haverson-Colombo associations. Sharptail grouse are throughout the survey area where good grassy cover is available. Turkeys are along wooded bottom land and in woody draws throughout the survey area.

Individual soils have varying potentials for the development and maintenance of wildlife habitat elements. Therefore, the soil affects the degree or extent to which wildlife habitat can be established or improved. In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are winter wheat, oats, and spring wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available

water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are intermediate wheatgrass, pubescent wheatgrass, and alfalfa.

Native herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are big bluestem, goldenrod, beggarweed, western wheatgrass, and blue grama.

Planted trees and shrubs include species that require cultivation before and during establishment. They eventually provide fruit, buds, twigs, bark, and foliage. Soil properties that affect the growth of trees and shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of these plants are green ash, Russian-olive, plum, chokecherry, Rocky Mountain juniper, and eastern redcedar.

Native deciduous trees and woody understory produce nuts or other fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwoods and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are elm, cottonwood, ash, bur oak, willow, plum, and chokecherry.

Native coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Native shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are skunkbush sumac, gooseberry, and snowberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

Information concerning the habitat elements needed to maintain and manage specific wildlife species can be obtained from the local office of the Natural Resources Conservation Service or from the South Dakota Department of Game, Fish, and Parks.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, the shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the

potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrinking and swelling can cause the movement of footings. A high water table, depth to bedrock, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. The depth to bedrock, a high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), the shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil

through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Bedrock interferes with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, and flooding.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope and bedrock can cause construction problems.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the

suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by a high water table and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and the shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential or slopes of 15 to 25 percent. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability in the soil and the depth to fractured bedrock or other permeable

material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; and susceptibility to flooding. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to help control erosion and conserve moisture by intercepting runoff. Slope, wetness, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 9). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than

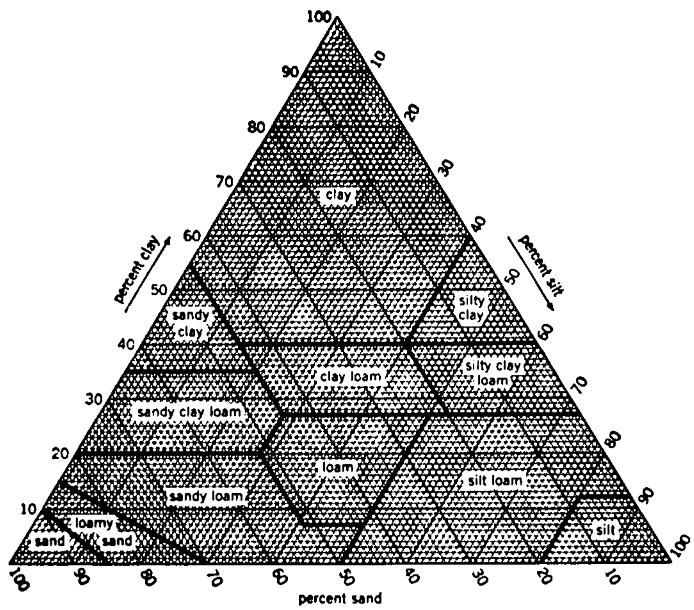

Figure 9.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated content of clay in each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity

of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, more than 6 percent; and *very high*, greater than 9 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are

assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water table rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause

damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(10)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that has a ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup that is dryer than typical for the great group. An example is Aridic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Aridic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(11)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(10)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Altvan Series

The Altvan series consists of well drained soils that formed in loamy alluvium. These soils are moderately deep to gravelly material. They are on high terraces. Permeability is moderate in the subsoil and very rapid

in the underlying material. Slopes range from 0 to 9 percent.

Typical pedon of Altvan loam, 0 to 2 percent slopes, 1,000 feet south and 500 feet west of the northeast corner of sec. 18, T. 2 S., R. 13 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

Bt—7 to 20 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; shiny films on faces of peds; neutral; gradual wavy boundary.

Bk1—20 to 28 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

Bk2—28 to 38 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse blocky structure; hard, friable, slightly sticky; few fine accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

2C—38 to 60 inches; yellowish brown (10YR 5/4) gravelly sand, brown (10YR 4/3) moist; single grain; about 20 percent gravel; slight effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 9 to 20 inches. Depth to the 2C horizon ranges from 30 to 40 inches. The depth to carbonate ranges from 16 to 24 inches. The Bt horizon is clay loam or sandy clay loam. The 2C horizon is sand or gravelly sand and contains 7 to 25 percent, by volume, gravel.

Arvada Series

The Arvada series consists of deep, well drained, sodium-affected soils that formed in alluvium. These soils are on plains and alluvial fans. Permeability is very slow. Slopes range from 0 to 4 percent.

Typical pedon of Arvada loam, 0 to 4 percent slopes, 2,500 feet north and 700 feet east of the southwest corner of sec. 17, T. 1 S., R. 15 E.

E—0 to 2 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to moderate fine granular; soft, very friable; mildly alkaline; abrupt smooth boundary.

Bt—2 to 11 inches; grayish brown (10YR 5/2) clay loam, brown (10YR 4/3) moist; moderate fine and medium columnar structure parting to moderate medium blocky; hard, firm, sticky and plastic; shiny films on faces of peds; strongly alkaline; clear smooth boundary.

Btz—11 to 21 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine accumulations of salts; slight effervescence; strongly alkaline; clear wavy boundary.

C—21 to 60 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, sticky and plastic; common fine accumulations of salts; slight effervescence; strongly alkaline.

The E horizon is 1 to 4 inches thick. It is dominantly loam but in some pedons is fine sandy loam. The Bt and C horizons are clay loam or clay. The depth to carbonate and salts ranges from 0 to 12 inches.

Baca Series

The Baca series consists of deep, well drained soils that formed in mixed sediments. These soils are on terraces and alluvial fans. Permeability is moderately slow. Slopes range from 0 to 4 percent.

Typical pedon of Baca silt loam, 0 to 4 percent slopes, 1,850 feet south and 450 feet west of the northeast corner of sec. 18, T. 3 N., R. 15 E.

A—0 to 5 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

Bt—5 to 13 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium and fine prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

Btk—13 to 19 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear wavy boundary.

Bk—19 to 34 inches; gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—34 to 60 inches; gray (10YR 6/1) silty clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to carbonate ranges from 8 to 15 inches.

Bankard Series

The Bankard series consists of deep, somewhat excessively drained, rarely flooded soils that formed in sandy alluvium. These soils are on flood plains. Permeability is rapid. Slopes range from 0 to 4 percent.

Typical pedon of Bankard loamy fine sand, 0 to 4 percent slopes, 1,560 feet south and 460 feet west of the northeast corner of sec. 32, T. 1 S., R. 13 E.

A—0 to 7 inches; light brownish gray (2.5Y 6/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure parting to single grain; loose; slight effervescence; mildly alkaline; clear smooth boundary.

C1—7 to 24 inches; light brownish gray (2.5Y 6/2) loamy sand that has thin layers of sandy loam, fine sandy loam, and silt loam; dark grayish brown (2.5Y 4/2) moist; single grain; soft, very friable; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—24 to 60 inches; multicolored sand that has thin layers of gravel; single grain; loose; slight effervescence; moderately alkaline.

The thickness of the A horizon ranges from 4 to 7 inches. The A horizon is dominantly loamy fine sand but in some pedons is fine sand. The C horizon contains less than 15 percent, by volume, gravel.

Beckton Series

The Beckton series consists of deep, moderately well drained, sodium-affected soils that formed in alluvium. These soils are on high terraces. Permeability is slow. Slopes range from 0 to 9 percent.

Typical pedon of Beckton silt loam, 0 to 4 percent slopes, 2,340 feet north and 2,080 feet west of the southeast corner of sec. 26, T. 2 N., R. 10 E.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; slightly acid; clear smooth boundary.

E—4 to 6 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak thin platy structure; soft, friable; neutral; abrupt smooth boundary.

Bt1—6 to 11 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to moderate medium blocky; hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

Bt2—11 to 18 inches; dark grayish brown (10YR 4/2) silty clay; very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; mildly alkaline; gradual smooth boundary.

Bz—18 to 28 inches; dark grayish brown (10YR 4/2) silty clay, dark grayish brown (10YR 4/2) moist; weak coarse blocky structure; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; few fine accumulations of salts; gradual wavy boundary.

C—28 to 60 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; hard, firm, sticky and plastic; strong effervescence; mildly alkaline; few fine accumulations of carbonate and salts.

The thickness of the mollic epipedon ranges from 11 to 20 inches. The thickness of the surface soil ranges from 6 to 11 inches. The depth to free carbonates ranges from 10 to 20 inches. Some pedons have sand or gravelly sand below a depth of 50 inches. The A horizon is dominantly silt loam but in some pedons is loam. Some pedons do not have an A horizon. The Bt and Bz horizons are silty clay, silty clay loam, or clay.

Blackpipe Series

The Blackpipe series consists of moderately deep, well drained soils that formed in material weathered from soft mudstone or interbedded shale and sandstone. These soils are on dissected plains and other plains. Permeability is moderately slow. Slopes range from 0 to 12 percent.

Typical pedon of Blackpipe clay loam, 2 to 6 percent slopes, 50 feet south and 1,056 feet west of the northeast corner of sec. 30, T. 1 S., R. 16 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, firm, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

Bt1—5 to 12 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine and medium prismatic structure parting to weak fine blocky; hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

Bt2—12 to 17 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium prismatic structure parting to weak fine blocky; hard, firm, sticky and plastic; slight

effervescence; mildly alkaline; clear wavy boundary.

Bk—17 to 29 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; massive; about 10 percent soft, fine fragments of mudstone; hard, firm, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—29 to 60 inches; white (10YR 8/2), soft mudstone bedrock, light gray (10YR 7/2) moist; strong effervescence.

The mollic epipedon ranges from 7 to 11 inches in thickness. The depth to free carbonates typically ranges from 12 to 24 inches. The A horizon is clay loam or silty clay loam. The Bt horizon is clay, clay loam, or silty clay. The Bk horizon is clay loam or silty clay and contains 5 to 20 percent, by volume, soft fragments of mudstone.

Blackpipe silty clay loam, 0 to 2 percent slopes (BkA), Blackpipe silty clay loam, 2 to 6 percent slopes (BkB), and the Blackpipe soil in the Blackpipe-Wortman complex, 0 to 3 percent slopes (BoA), are taxadjuncts to the series because they have mixed mineralogy. This difference, however, does not affect the use or management of the soils.

Bridgeport Series

The Bridgeport series consists of deep, well drained, rarely flooded soils that formed in silty alluvium. These soils are on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Bridgeport silt loam, 30 feet south and 1,584 feet west of the northeast corner of sec. 21, T. 2 N., R. 8 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable; slight effervescence; neutral; clear smooth boundary.

A—7 to 16 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; slightly hard, friable; very few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

Bw—16 to 24 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

C1—24 to 50 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; massive; hard, friable; thin bedding planes; strong effervescence; moderately alkaline; clear smooth boundary.

C2—50 to 60 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; very few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 11 to more than 20 inches. The control section ranges from 20 to 30 percent clay and has less than 15 percent fine or coarser sand. The depth to free carbonates is 0 to 12 inches. The Bw horizon is silt loam or silty clay loam. In some pedons, the C horizon has thin strata of loam, very fine sandy loam, silt loam, and silty clay loam. Some pedons have buried surface horizons.

Cactusflat Series

The Cactusflat series consists of deep, well drained soils that formed in sodium-rich alluvium. These soils are on alluvial fans. Permeability is slow in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Cactusflat silty clay, in an area of Cactusflat-Weta complex, 950 feet north and 1,390 feet east of the southwest corner of sec. 1, T. 1 S., R. 16 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable, sticky and plastic; slight effervescence; neutral; clear smooth boundary.

Bw1—4 to 11 inches; gray (10YR 5/1) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and medium blocky; very hard, firm, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

Bw2—11 to 16 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; strong effervescence; moderately alkaline; clear wavy boundary.

BC—16 to 22 inches; gray (10YR 5/1) silty clay, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and plastic; violent effervescence; moderately alkaline; clear wavy boundary.

2C—22 to 60 inches; white (10YR 8/2), stratified silty clay loam, clay loam, and very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 14 inches. The depth to carbonate ranges from 0 to 6 inches. The A horizon is dominantly silty clay but in some pedons is silty clay loam. The BC horizon is silty clay or silty clay loam. The 2C horizon is stratified silty clay loam, clay loam, or very fine sandy loam.

Cedarpass Series

The Cedarpass series consists of deep, well drained soils that formed in sodium-rich, silty sediments. These soils are on terraces. Permeability is moderate. Slopes range from 0 to 6 percent.

Typical pedon of Cedarpass silty clay loam, 0 to 3 percent slopes, 500 feet south and 1,650 feet west of the northeast corner of sec. 9, T. 3 S., R. 16 E.

A—0 to 5 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

Bw1—5 to 9 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; fine stratification; strong effervescence; moderately alkaline; clear wavy boundary.

Bw2—9 to 13 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable; fine stratification; strong effervescence; moderately alkaline; clear wavy boundary.

C1—13 to 34 inches; white (10YR 8/2), stratified silt loam and silty clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; strong effervescence; strongly alkaline; clear wavy boundary.

C2—34 to 51 inches; light brownish gray (10YR 6/2), stratified silt loam and silty clay loam, brown (10YR 5/3) moist; massive; hard, firm; strong effervescence; strongly alkaline; clear wavy boundary.

C3—51 to 60 inches; white (10YR 8/2), stratified silt loam and silty clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; strong effervescence; strongly alkaline.

The depth to carbonate ranges from 0 to 10 inches. The A horizon is silty clay loam, silt loam, or loam. The Bw horizon is silty clay loam or loam. Some pedons have a BC horizon. Some pedons do not have stratification.

Colby Series

The Colby series consists of deep, well drained, calcareous soils that formed in silty sediments. These soils are on dissected plains. Permeability is moderate. Slopes range from 6 to 40 percent.

Typical pedon of Colby silt loam, in an area of Colby-Norka silt loams, 6 to 15 percent slopes, 580 feet south and 2,610 feet west of the northeast corner of sec. 28, T. 6 S., R. 8 E.

A—0 to 6 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine granular structure; soft, friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—6 to 52 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; few fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C2—52 to 60 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; massive; very friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 3 inches. Some pedons have an AC horizon.

Colombo Series

The Colombo series consists of deep, well drained, rarely flooded and occasionally flooded soils that formed in loamy alluvium. These soils are on flood plains. Permeability is moderate. Slopes range from 0 to 3 percent.

Typical pedon of Colombo loam, 1,100 feet south and 200 feet east of the northwest corner of sec. 23, T. 1 N., R. 8 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable; slight effervescence; moderately alkaline; 5 to 10 percent coarse fragments less than 6 inches in diameter; clear smooth boundary.

A—8 to 14 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, friable; slight effervescence; moderately alkaline; 5 to 10 percent coarse fragments less than 6 inches in diameter; clear smooth boundary.

C1—14 to 24 inches; brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline; clear wavy boundary.

C2—24 to 31 inches; stratified yellowish brown (10YR 5/4) and light gray (10YR 7/1) sandy clay loam, brown (7.5YR 4/4) and grayish brown (10YR 5/2) moist; massive; slightly hard, friable; strong effervescence; about 10 percent coarse fragments 1 to 3 inches in diameter; strongly alkaline; gradual wavy boundary.

C3—31 to 60 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; massive; slightly hard, friable; slight effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 9 to 18 inches. The depth to carbonate ranges from 0 to 5 inches. The soils contain 0 to 15 percent, by volume, coarse fragments less than 6 inches in diameter throughout.

The A horizon is dominantly loam but is silt loam in some pedons. The C horizon is stratified very fine sandy loam, loam, or sandy clay loam. Some pedons have thin strata of gravelly sand.

Conata Series

The Conata series consists of shallow, well drained soils that formed in multicolored material weathered from soft mudstone or shale. These soils are on dissected plains. Permeability is very slow. Slopes range from 6 to 25 percent.

Typical pedon of Conata silty clay, in an area of Conata-Hisle complex, 6 to 25 percent slopes, 400 feet south and 500 feet west of the northeast corner of sec. 2, T. 4 S., R. 17 E.

A—0 to 3 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

Bw—3 to 8 inches; brown (10YR 4/3) silty clay, dark yellowish brown (10YR 4/4) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; about 10 percent soft, fine fragments of shale; slight effervescence; neutral; clear wavy boundary.

Bk—8 to 14 inches; grayish brown (10YR 5/2) silty clay, reddish brown (5YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; about 40 percent soft, fine and medium fragments of shale; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—14 to 60 inches; multicolored, soft shale bedrock; strong effervescence.

The B horizon has 10 to 55 percent, by volume, soft fragments of shale. Some pedons have a C horizon. The Cr horizon is multicolored, soft shale or mudstone.

Cushman Series

The Cushman series consists of moderately deep, well drained soils that formed in material weathered from soft, interbedded shale and sandstone. These soils are on dissected plains. Permeability is moderate. Slopes range from 6 to 15 percent.

Typical pedon of Cushman loam, in an area of Cushman-Shingle loams, 9 to 15 percent slopes, 1,850 feet south and 1,450 feet east of the northwest corner of sec. 32, T. 5 N., R. 16 E.

A—0 to 3 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, friable; neutral; abrupt smooth boundary.

Bt—3 to 10 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bk—10 to 16 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C—16 to 29 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable; about 25 percent soft, fine fragments of shale and sandstone; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—29 to 60 inches; pale yellow (2.5Y 7/4) and yellowish brown (10YR 5/6), soft interbedded shale and sandstone bedrock; strong effervescence.

The depth to weathered bedrock ranges from 25 to 40 inches. The depth to carbonate ranges from 7 to 16 inches. The C horizon has 20 to 30 percent, by volume, soft fragments of shale and sandstone.

Denby Series

The Denby series consists of deep, well drained, calcareous soils that formed in sodium-rich, clayey alluvium. These soils are on terraces. Permeability is slow in the upper part and moderately slow in the underlying material. Slopes range from 0 to 3 percent.

Typical pedon of Denby silty clay, in an area of Cedarpass-Denby complex, 0 to 3 percent slopes, 175

feet south and 200 feet west of the northeast corner of sec. 4, T. 3 S., R. 16 E.

A—0 to 3 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; weak fine granular structure; hard, firm, sticky and plastic; strong effervescence; moderately alkaline; abrupt smooth boundary.

Bw1—3 to 6 inches; light brownish gray (10YR 6/2) clay, brown (10YR 5/3) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; strong effervescence; moderately alkaline; abrupt smooth boundary.

Bw2—6 to 22 inches; light brownish gray (10YR 6/2) clay, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; very hard, very firm, sticky and plastic; cracks 0.5 to 1.0 inch wide; strong effervescence; moderately alkaline; clear smooth boundary.

BC—22 to 26 inches; light gray (10YR 7/2) clay loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; strong effervescence; strongly alkaline; clear wavy boundary.

2C—26 to 60 inches; light gray (10YR 7/2), stratified silty clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; strong effervescence; strongly alkaline.

Carbonates typically are at the surface but in some pedons are leached to a depth of several inches. The Bw horizon is clay, silty clay, or silty clay loam. The 2C horizon is stratified clay loam, silty clay loam, or silt loam.

Egas Series

The Egas series consists of deep, poorly drained, occasionally flooded soils that formed in clayey alluvium. These soils are on flood plains. Permeability is slow. Slopes range from 0 to 2 percent.

Typical pedon of Egas silty clay loam, 185 feet north and 1,380 feet west of the southeast corner of sec. 30, T. 3 N., R. 17 E.

Az—0 to 5 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak fine and medium granular structure; hard, friable, sticky and plastic; few fine and medium accumulations of salts; slight effervescence; moderately alkaline; clear wavy boundary.

ACz—5 to 18 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure; very hard, firm, sticky and plastic; few fine accumulations of salts; strong effervescence; strongly alkaline; clear wavy boundary.

Cg1—18 to 37 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few medium accumulations of salts; strong effervescence; strongly alkaline; clear wavy boundary.

Cg2—37 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct pale yellow (2.5Y 7/4) mottles; massive; very hard, firm, sticky and plastic; common medium accumulations of salts; slight effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 10 to 22 inches. The depth to salts ranges from 0 to 4 inches.

Emigrant Series

The Emigrant series consists of moderately deep, well drained soils that formed in residuum over soft, interbedded sandstone and mudstone or mudstone. These soils are on plains. Permeability is moderately slow. Slopes range from 0 to 6 percent.

Typical pedon of Emigrant loam, 2 to 6 percent slopes, 950 feet south and 350 feet east of the northwest corner of sec. 14, T. 2 S., R. 8 E.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; neutral; clear smooth boundary.

Bt—6 to 12 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Btk—12 to 20 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few fine accumulations of carbonate; slight effervescence; moderately alkaline; clear smooth boundary.

Bk—20 to 26 inches; light yellowish brown (10YR 6/4) clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—26 to 33 inches; light yellowish brown (10YR 6/4) clay loam, brown (10YR 5/3) moist; massive; hard,

firm, sticky and plastic; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—33 to 60 inches; stratified brown (7.5YR 5/4) and light brownish gray (2.5Y 6/2), soft, interbedded mudstone and sandstone bedrock; strong effervescence.

The thickness of the mollic epipedon ranges from 6 to 14 inches. The depth to bedrock ranges from 20 to 40 inches. The depth to carbonate ranges from 12 to 21 inches. The Cr horizon is soft, interbedded mudstone and sandstone or mudstone.

Enning Series

The Enning series consists of shallow, well drained, calcareous soils that formed in material weathered from soft, chalky shale. These soils are on dissected plains. Permeability is moderate. Slopes range from 9 to 25 percent.

Typical pedon of Enning silt loam, in an area of Enning-Minnequa silt loams, 9 to 25 percent slopes, 1,300 feet south and 50 feet west of the northeast corner of sec. 17, T. 1 N., R. 8 E.

A—0 to 4 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, friable; about 5 percent soft, fine fragments of shale; strong effervescence; mildly alkaline; clear smooth boundary.

C—4 to 18 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; about 25 percent soft, fine and medium fragments of shale; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—18 to 60 inches; very pale brown (10YR 7/4) and light gray (10YR 6/1), soft, chalky shale bedrock, yellowish brown (10YR 5/4) and gray (10YR 5/1) moist; bedding planes; strong effervescence.

The depth to weathered bedrock ranges from 10 to 20 inches. The control section contains 15 to 25 percent, by volume, soft fragments of shale.

Fairburn Series

The Fairburn series consists of shallow, well drained soils that formed in material weathered from soft mudstone or very fine grained sandstone. These soils are on dissected plains. Permeability is moderate. Slopes range from 9 to 45 percent.

Typical pedon of Fairburn clay loam, in an area of Fairburn-Badland complex, 9 to 40 percent slopes, 2,300 feet north and 900 feet east of the southwest corner of sec. 5, T. 4 S., R. 14 E.

A—0 to 4 inches; brown (10YR 5/3) clay loam, grayish brown (10YR 5/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; slight effervescence; neutral; clear smooth boundary.

AC—4 to 10 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; clear wavy boundary.

C—10 to 15 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; about 10 percent soft, very fine grained fragments of sandstone; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—15 to 60 inches; light gray (2.5Y 7/2), weathered, soft, interbedded, very fine grained sandstone and mudstone bedrock, light brownish gray (2.5Y 6/2) moist; strong effervescence.

The depth to weathered bedrock ranges from 10 to 20 inches. The control section contains 0 to 15 percent, by volume, soft fragments of sandstone or mudstone. The depth to free carbonates ranges from 0 to 4 inches. The A horizon is clay loam, silty clay loam, or gravelly clay loam. The C horizon is silty clay loam or clay loam.

Glenberg Series

The Glenberg series consists of deep, well drained, rarely flooded soils that formed in stratified, loamy alluvium. These soils are on flood plains. Permeability is moderately rapid. Slopes range from 0 to 3 percent.

Typical pedon of Glenberg fine sandy loam, 500 feet north and 350 feet east of the southwest corner of sec. 13, T. 5 S., R. 9 E.

A—0 to 4 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—4 to 60 inches; light brownish gray (2.5Y 6/2), stratified fine sandy loam and sandy loam, dark grayish brown (2.5Y 4/2) moist; loose; strong effervescence; moderately alkaline.

The depth to carbonate ranges from 0 to 6 inches. The A horizon is dominantly fine sandy loam but in some pedons is sandy loam. The C horizon is stratified fine sandy loam, sandy loam, silt loam, loamy fine sand, gravelly loamy sand, or very fine sandy loam.

Grummit Series

The Grummit series consists of shallow, well drained soils that formed in material weathered from soft, acid shale. These soils are on dissected plains. Permeability is moderately slow. Slopes range from 6 to 40 percent.

Typical pedon of Grummit clay, in an area of Grummit-Rock outcrop complex, 6 to 40 percent slopes, 1,300 feet south and 675 feet east of the northwest corner of sec. 13, T. 2 N., R. 7 E.

A—0 to 3 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine and medium granular structure; slightly hard, friable, sticky and plastic; strongly acid; clear smooth boundary.

C—3 to 12 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; about 25 percent soft fragments of shale; strongly acid; gradual wavy boundary.

Cr—12 to 60 inches; gray (5Y 5/1), platy, soft shale bedrock, dark gray (5Y 4/1) moist; common fine distinct brownish yellow (10YR 6/6) stains; hard.

The control section contains 20 to 35 percent, by volume, soft fragments of shale.

Haverson Series

The Haverson series consists of deep, well drained, rarely flooded and occasionally flooded soils that formed in loamy alluvium. These soils are on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Haverson silt loam, 1,100 feet south and 1,460 feet east of the northwest corner of sec. 18, T. 3 N., R. 15 E.

A—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; slight effervescence; neutral; clear smooth boundary.

C1—5 to 15 inches; pale brown (10YR 6/3), stratified very fine sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to very thin platy; hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

C2—15 to 34 inches; grayish brown (2.5Y 5/2), stratified silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

C3—34 to 60 inches; light brownish gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; single grain; loose; slight effervescence; mildly alkaline.

The control section is stratified sandy loam to silty clay loam. It has 0 to 15 percent, by volume, coarse fragments 0.5 inch to 4.0 inches in diameter. The A horizon is typically silt loam but in some pedons is loam.

Hisle Series

The Hisle series consists of moderately deep, well drained, sodium-affected soils that formed in material weathered from soft shale or mudstone. These soils are on dissected plains and other plains. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Hisle silt loam, 0 to 6 percent slopes, 880 feet north and 2,180 feet west of the southeast corner of sec. 12, T. 1 S., R. 16 E.

E—0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure parting to weak fine granular; soft, very friable; neutral; abrupt smooth boundary.

Bt1—2 to 5 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; weak fine and medium columnar structure parting to moderate fine blocky; hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; clear smooth boundary.

Bt2—5 to 15 inches; brown (10YR 5/3) silty clay, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium blocky; hard, very firm, sticky and plastic; strong effervescence; mildly alkaline; clear wavy boundary.

Bkz—15 to 21 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; moderate medium blocky structure; hard, very firm, sticky and plastic; few medium accumulations of carbonate and salts; strong effervescence; moderately alkaline; clear wavy boundary.

C—21 to 28 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; massive; hard, very firm, sticky and plastic; few fine accumulations of carbonate; about 30 percent soft, fine fragments of shale; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—28 to 60 inches; light gray (10YR 7/2), soft shale bedrock, grayish brown (10YR 5/2) moist; slight effervescence.

The depth to weathered bedrock ranges from 25 to 40 inches. The thickness of the E horizon is 0.5 inch to 3.0 inches. Free carbonates are at or near the surface. The Cr horizon is soft shale or mudstone.

Hoven Series

The Hoven series consists of deep, poorly drained, sodium-affected soils that formed in clayey alluvium. These soils are in closed depressions on plains. Permeability is very slow. Slopes are less than 1 percent.

The Hoven soils in this survey area are taxadjuncts to the series because they do not have a mollic epipedon. This difference, however, does not affect the use or management of the soils.

Typical pedon of Hoven silt loam, 200 feet south and 2,640 feet east of the northwest corner of sec. 5, T. 1 N., R. 16 E.

E—0 to 6 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; few fine faint and distinct very pale brown (10YR 7/3) and light yellowish brown (10YR 6/4) mottles; weak very thin and thin platy structure; soft, very friable; medium acid; abrupt smooth boundary.

Bt1—6 to 14 inches; grayish brown (10YR 5/2) clay, dark brown (10YR 3/3) moist; few fine faint yellowish brown (10YR 5/4) mottles; strong coarse columnar structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; slightly acid; clear wavy boundary.

Bt2—14 to 27 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong coarse prismatic structure parting to strong medium and fine blocky; extremely hard, very firm, sticky and plastic; mildly alkaline; clear wavy boundary.

Bk—27 to 34 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong coarse and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1—34 to 44 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; few fine distinct brownish yellow (10YR 6/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—44 to 52 inches; very pale brown (10YR 7/4) silty clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—52 to 60 inches; very pale brown (10YR 8/3) and pink (7.5YR 7/4), soft, interbedded sandstone and shale bedrock, very pale brown (10YR 7/3) and light brown (7.5YR 6/4) moist; strong effervescence.

Some pedons are more than 60 inches deep over bedrock. The thickness of the E horizon is 4 to 7 inches. The depth to free carbonates ranges from 15 to 30 inches. The Bt and C horizons are clay, silty clay, or silty clay loam.

Hoven Variant

The Hoven Variant consists of deep, very poorly drained soils that formed in clayey alluvium. These soils are in closed depressions. Cracks that are 0.5 inch to 2.0 inches wide and several feet long extend into the subsoil during dry periods. Permeability is very slow. Slopes are less than 1 percent.

Typical pedon of Hoven Variant silty clay, ponded, 175 feet north and 450 feet west of the southeast corner of sec. 2, T. 1 N., R. 15 E.

A—0 to 5 inches; dark gray (2.5Y 4/0) silty clay, very dark gray (2.5Y 3/0) moist; weak fine and medium granular structure; hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

Bw—5 to 19 inches; dark gray (2.5Y 4/0) clay, very dark gray (2.5Y 3/0) moist; weak medium prismatic structure parting to weak medium blocky; very hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

Bz—19 to 26 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak coarse subangular blocky structure parting to weak medium blocky; very hard, firm, sticky and plastic; few medium and fine accumulations of salts; slight effervescence; mildly alkaline; clear smooth boundary.

C—26 to 50 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few medium faint yellow (2.5Y 7/6) mottles; massive; very hard, firm, sticky and plastic; common fine accumulations of salts; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—50 to 60 inches; light gray (2.5Y 7/2), soft, interbedded sandstone and shale bedrock, light brownish gray (2.5Y 6/2) moist; common medium distinct brownish yellow (10YR 6/6) mottles; strong effervescence.

The thickness of the mollic epipedon ranges from 12 to 24 inches. Mottles are at a depth of 17 to 26 inches. Ponding usually occurs during the growing season and lasts from 1 to 12 months. The depth to free carbonates and salts ranges from 15 to 20 inches.

The A horizon has hue of 2.5Y or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 0 or 1. The B horizon has hue of 10YR to 5Y, value of 4 or 5 (3 or 4 moist), and chroma of 0 to 2. The C horizon has hue of 2.5Y or 5Y and value of 4 or 5 (3 or 4 moist).

Interior Series

The Interior series consists of deep, well drained, rarely flooded to frequently flooded soils that formed in sodium-rich alluvium. These soils are on silty and loamy alluvial fans and flood plains. Permeability is moderate. Slopes range from 0 to 3 percent.

Typical pedon of Interior loam, 1,250 feet south and 20 feet east of the northwest corner of sec. 13, T. 3 S., R. 15 E.

A—0 to 2 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak very thin platy structure parting to weak fine granular; soft, very friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1—2 to 13 inches; white (10YR 8/2), stratified silt loam and silty clay loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable; violent effervescence; strongly alkaline; clear wavy boundary.

C2—13 to 27 inches; light gray (10YR 7/2), stratified silty clay loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C3—27 to 60 inches; light gray (10YR 7/2), stratified silt loam and silty clay loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The A horizon is dominantly loam. In some pedons it is silt loam, very fine sandy loam, or silty clay loam. The C horizon is silt loam and silty clay loam and has thin layers of very fine sandy loam, loam, clay loam, silty clay, and clay.

Jayem Series

The Jayem series consists of deep, well drained soils that formed in loamy and sandy eolian sediments. These soils are on dissected plains and other plains. Permeability is moderately rapid. Slopes range from 0 to 9 percent.

Typical pedon of Jayem fine sandy loam, 3 to 9 percent slopes, 440 feet north and 2,640 feet west of the southeast corner of sec. 29, T. 2 S., R. 13 E.

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

A2—7 to 18 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable; neutral; clear wavy boundary.

Bw—18 to 35 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure; soft, very friable; neutral; gradual wavy boundary.

C—35 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grain; loose; neutral.

The thickness of the mollic epipedon is 7 to 20 inches.

Kyle Series

The Kyle series consists of deep, well drained soils that formed in clayey sediments weathered from soft shale. These soils are on alluvial fans. Cracks that are 0.5 inch to 2.0 inches wide and several feet long extend into the subsoil during dry periods. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Kyle clay, 0 to 3 percent slopes, 1,090 feet south and 15 feet east of the northwest corner of sec. 7, T. 6 S., R. 9 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; hard, firm, sticky and plastic; neutral; clear smooth boundary.

Bw—4 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to weak medium and fine blocky; very hard, very firm, sticky and plastic; few intersecting slickensides; slight effervescence; mildly alkaline; gradual wavy boundary.

BC—18 to 25 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium blocky; very hard, very firm, sticky and plastic; few intersecting slickensides; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C—25 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, very firm, sticky and plastic; few fine accumulations of salts; strong effervescence; mildly alkaline.

In some pedons shale bedrock is at a depth of 40 to 60 inches. The depth to carbonate ranges from 0 to 6 inches.

Kyle clay, 0 to 1 percent slopes (KtA), is a taxadjunct to the series because it has a mollic epipedon. This difference, however, does not affect the use or management of the soils.

Larvie Series

The Larvie series consists of moderately deep, well drained soils that formed in material weathered from soft, multicolored shale and mudstone. These soils are on dissected plains and other plains. Cracks that are 0.5 inch to 2.0 inches wide and several feet long extend into the subsoil during dry periods. Permeability is very slow. Gilgai relief is prominent. Slopes range from 0 to 15 percent.

Typical pedon of Larvie clay, in an area of Larvie-Hisle complex, 0 to 9 percent slopes, 1,550 feet north and 2,050 feet east of the southwest corner of sec. 33, T. 3 S., R. 16 E.

A—0 to 3 inches; brown (7.5YR 4/2) clay, brown (7.5YR 4/2) moist; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bw—3 to 12 inches; reddish gray (5YR 5/2) clay, reddish brown (5YR 4/3) moist; weak medium prismatic structure parting to moderate medium blocky; very hard, very firm, very sticky and very plastic; few intersecting slickensides; strong effervescence; moderately alkaline; clear wavy boundary.

Bk—12 to 20 inches; weak red (2.5YR 5/2) clay, reddish brown (5YR 4/3) moist; weak medium blocky structure; very hard, very firm, very sticky and very plastic; few intersecting slickensides; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—20 to 29 inches; weak red (10R 5/3) clay, weak red (10R 4/3) moist; massive; very hard, very firm, sticky and plastic; about 25 percent soft, fine fragments of shale; few fine accumulations of carbonate and salts; violent effervescence; mildly alkaline; diffuse wavy boundary.

Cr—29 to 60 inches; weak red (10R 5/3), soft shale bedrock, weak red (10R 4/3) moist; very hard and brittle; few medium accumulations of carbonate and salts; strong effervescence.

The depth to soft shale ranges from 20 to 40 inches. Some pedons have accumulations of gypsum and other salts in the Bk horizon. Some pedons do not have a C horizon.

Lohmiller Series

The Lohmiller series consists of deep, well drained, rarely flooded to occasionally flooded soils that formed in alluvium. These soils are on flood plains. Permeability is slow. Slopes range from 0 to 3 percent.

Typical pedon of Lohmiller silty clay, 1,500 feet north and 1,200 feet west of the southeast corner of sec. 32, T. 5 N., R. 15 E.

A—0 to 6 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium granular structure; slightly hard, friable; slight effervescence; neutral; abrupt smooth boundary.

C—6 to 60 inches; light brownish gray (2.5Y 6/2), stratified silty clay loam and silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 0 to 10 inches. The C horizon is silty clay, silty clay loam, or clay. Some pedons have thin layers of loamy sand, fine sandy loam, loam, or silt loam.

Manvel Series

The Manvel series consists of deep, well drained soils that formed in silty sediments weathered from chalky shale or limestone. These soils are on dissected plains and other plains. Permeability is moderate. Slopes range from 0 to 15 percent.

Typical pedon of Manvel silt loam, 0 to 6 percent slopes, 620 feet north and 500 feet east of the southwest corner of sec. 28, T. 5 S., R. 7 E.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable, slightly sticky; slight effervescence; moderately alkaline; clear smooth boundary.

AC—4 to 13 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky; slight effervescence; moderately alkaline; gradual smooth boundary.

C—13 to 60 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; massive; hard, friable, slightly sticky; violent effervescence; moderately alkaline.

The control section has 15 to 35 percent calcium carbonate equivalent. The A horizon is typically silt loam but in some pedons is silty clay loam. Some pedons do not have an AC horizon.

Midway Series

The Midway series consists of shallow, well drained, calcareous soils that formed in material weathered from soft shale. These soils are on dissected plains. Permeability is slow. Slopes range from 9 to 40 percent.

Typical pedon of Midway silty clay loam, 15 to 40 percent slopes, 1,560 feet north and 1,160 feet west of the southeast corner of sec. 19, T. 2 N., R. 17 E.

A—0 to 4 inches; yellowish brown (10YR 5/4) silty clay loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; clear smooth boundary.

C1—4 to 9 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; about 15 percent soft, fine fragments of shale and sandstone; strong effervescence; moderately alkaline; clear smooth boundary.

C2—9 to 16 inches; light brownish gray (2.5Y 6/2) and brownish yellow (10YR 6/6) clay loam, grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) moist; massive; hard, friable, slightly sticky and slightly plastic; about 30 percent soft, fine and medium fragments of shale and sandstone; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—16 to 60 inches; light brownish gray (2.5Y 6/2) and brownish yellow (10YR 6/6), soft, interbedded shale and sandstone bedrock, grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) moist; strong effervescence.

The depth to free carbonates ranges from 0 to 8 inches. Some pedons have 15 to 35 percent, by volume, coarse fragments in the surface layer. The A horizon is silty clay loam or clay loam. The C horizon is silty clay loam, clay loam, or silty clay. It has 15 to 30 percent, by volume, soft fragments of shale and sandstone. The Cr horizon is soft, interbedded, calcareous shale and sandstone.

Minnequa Series

The Minnequa series consists of moderately deep, well drained soils that formed in material weathered from interbedded, hard limestone and soft, chalky shale. These soils are on dissected plains. Permeability is moderate. Slopes range from 2 to 12 percent.

Typical pedon of Minnequa silt loam, in an area of Minnequa-Penrose complex, 6 to 9 percent slopes, 250 feet north and 1,950 feet east of the southwest corner of sec. 28, T. 5 S., R. 7 E.

A—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

AC—5 to 17 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable; about 5 percent soft fragments of shale and hard fragments of limestone; common very fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C—17 to 26 inches; pale brown (10YR 6/3) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, slightly plastic; about 5 percent soft, fine fragments of shale and hard, medium fragments of limestone; common fine accumulations of carbonate; violent effervescence; moderately alkaline; diffuse wavy boundary.

Cr—26 to 60 inches; light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6), interbedded, hard limestone and soft, chalky shale bedrock, yellowish brown (10YR 5/4 and 5/6) moist; violent effervescence.

The depth to soft, chalky shale or hard limestone is 23 to 40 inches. The A horizon is dominantly silt loam but in some pedons is silty clay loam. The C horizon is silt loam or silty clay loam. The Cr horizon is soft, chalky shale, soft chalk, or hard limestone.

Nihill Series

The Nihill series consists of deep, excessively drained soils that formed in gravelly alluvium. These soils are on high terraces. Permeability is moderately rapid. Slopes range from 0 to 40 percent.

Typical pedon of Nihill gravelly loam, 9 to 40 percent slopes, 1,700 feet north and 800 feet east of the southwest corner of sec. 19, T. 1 S., R. 11 E.

A—0 to 5 inches; brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; about 25 percent gravel; slight effervescence; neutral; clear wavy boundary.

C—5 to 60 inches; light brownish gray (10YR 6/2) very gravelly loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; about 55 percent gravel; carbonate coatings on the underside of pebbles; strong effervescence; mildly alkaline.

Very gravelly material is within a depth of 10 inches. The content of gravel ranges from 35 to 65 percent in all parts of the control section. The A horizon is gravelly

loam or very gravelly loam. The C horizon is very gravelly loam to very gravelly sandy loam.

Norka Series

The Norka series consists of deep, well drained soils that formed in silty sediments. These soils are on dissected plains and other plains. Permeability is moderate. Slopes range from 0 to 12 percent.

Typical pedon of Norka silt loam, in an area of Norka-Weta silt loams, 0 to 3 percent slopes, 1,300 feet north and 2,900 feet west of the southeast corner of sec. 10, T. 2 S., R. 17 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

BA—4 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine blocky structure; slightly hard, friable; neutral; abrupt smooth boundary.

Bt—7 to 14 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm; mildly alkaline; clear smooth boundary.

Bk—14 to 18 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine blocky; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—18 to 60 inches; light gray (10YR 7/2), stratified silt loam, pale brown (10YR 6/3) moist; massive; hard, friable; common fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 8 to 15 inches. The depth to free carbonates ranges from 6 to 15 inches. Some pedons are not stratified in the C horizon.

Norrest Series

The Norrest series consists of moderately deep, well drained soils that formed in material weathered from soft mudstone. These soils are on dissected plains. Permeability is moderately slow. Slopes range from 6 to 15 percent.

Typical pedon of Norrest silty clay loam, 6 to 15 percent slopes, 250 feet north and 2,160 feet west of the southeast corner of sec. 36, T. 3 S., R. 7 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

Bt—4 to 13 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak medium and coarse prismatic structure parting to moderate medium and fine blocky; hard, friable, sticky and plastic; strong effervescence; mildly alkaline; gradual wavy boundary.

Btk—13 to 18 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to moderate medium blocky; hard, friable, sticky and plastic; about 10 percent soft, fine fragments of mudstone; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—18 to 29 inches; white (10YR 8/2) clay loam, light gray (10YR 7/2) moist; massive; hard, friable, sticky and plastic; about 30 percent soft, fine fragments of mudstone; few fine accumulations of carbonate; strong effervescence; moderately alkaline; diffuse wavy boundary.

Cr—29 to 60 inches; very pale brown (10YR 8/3), soft mudstone bedrock, very pale brown (10YR 7/3) moist; strong effervescence.

The depth to bedrock ranges from 20 to 40 inches. The soil contains free carbonates throughout. The A horizon is dominantly silty clay loam but in some pedons is silt loam or clay loam. The C horizon contains 10 to 35 percent, by volume, soft fragments of mudstone. Some pedons do not have a C horizon.

Nunn Series

The Nunn series consists of deep, well drained soils that formed in mixed alluvium. These soils are on high terraces. Permeability is slow. Slopes range from 0 to 12 percent.

Typical pedon of Nunn loam, 0 to 2 percent slopes, 370 feet south and 750 feet west of the northeast corner of sec. 12, T. 1 S., R. 17 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

BA—7 to 13 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bt1—13 to 18 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to strong medium blocky; very hard, firm, sticky and plastic; few distinct clay films; neutral; clear wavy boundary.

Bt2—18 to 25 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to strong medium blocky; very hard, firm, sticky and plastic; few distinct clay films; strong effervescence; mildly alkaline; clear wavy boundary.

Bk—25 to 29 inches; grayish brown (2.5Y 5/2) clay loam, olive brown (2.5Y 4/4) moist; weak medium and coarse blocky structure; very hard, firm, sticky and plastic; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—29 to 60 inches; olive (5Y 5/3) clay loam, olive (5Y 4/3) moist; massive; hard, firm, sticky and plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 9 to 19 inches. The depth to free carbonates ranges from 10 to 30 inches. The A horizon is dominantly loam but in some pedons is clay loam. Some pedons have a Btk horizon. The Bk horizon has few to many fine to medium accumulations of carbonate. The C horizon is clay loam or loam.

Orella Series

The Orella series consists of shallow, well drained, calcareous soils that formed in material weathered from soft, sodium-rich mudstone. These soils are on dissected plains. Permeability is very slow. Slopes range from 1 to 25 percent.

Typical pedon of Orella clay, in an area of Whitewater-Orella clays, 3 to 9 percent slopes, 25 feet south and 300 feet east of the northwest corner of sec. 27, T. 3 S., R. 16 E.

A—0 to 3 inches; light brownish gray (10YR 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate very fine granular structure; hard, firm, sticky and plastic; violent effervescence; moderately alkaline; clear smooth boundary.

AC—3 to 8 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; weak medium blocky structure; very hard, firm, very sticky and very plastic; about 15 percent soft, fine fragments of mudstone; violent effervescence; strongly alkaline; gradual wavy boundary.

C—8 to 14 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; massive; very hard, firm, very sticky and very plastic; about 45 percent soft, fine fragments of mudstone; violent effervescence; strongly alkaline; clear wavy boundary.

Cr—14 to 60 inches; white (2.5Y 8/1) and pale yellow (5Y 7/3), soft mudstone bedrock; strong effervescence.

The depth to soft mudstone ranges from 10 to 20 inches. The A horizon is clay, silty clay, or silty clay loam. The AC horizon contains 10 to 35 percent, by volume, soft fragments of mudstone. The C horizon contains 25 to 60 percent, by volume, soft fragments of mudstone. Some pedons have few or common accumulations of carbonate and salts in the C horizon.

Ottumwa Series

The Ottumwa series consists of deep, well drained soils that formed in clayey sediments. These soils are on dissected plains and other plains. Cracks that are 0.5 inch to 2.0 inches wide and several feet long extend into the subsoil during dry periods. Permeability is slow. Slopes range from 0 to 9 percent.

Typical pedon of Ottumwa clay, 2 to 6 percent slopes, 2,100 feet south and 850 feet west of the northeast corner of sec. 11, T. 2 N., R. 17 E.

Ap—0 to 7 inches; olive gray (5Y 4/2) clay, dark olive gray (5Y 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, firm, sticky and plastic; slight effervescence; moderately alkaline; clear smooth boundary.

Bw1—7 to 16 inches; olive gray (5Y 4/2) clay, dark olive gray (5Y 3/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; slight effervescence; strongly alkaline; clear wavy boundary.

Bw2—16 to 25 inches; olive gray (5Y 5/2) clay, olive (5Y 4/3) moist; common fine tongues of dark olive gray (5Y 3/2 moist) surface material; moderate medium blocky structure parting to moderate fine blocky; hard, firm, sticky and plastic; few intersecting slickensides; slight effervescence; moderately alkaline; clear wavy boundary.

Bk—25 to 32 inches; olive gray (5Y 5/2) clay, olive (5Y 4/3) moist; strong medium and coarse blocky structure parting to moderate medium and fine blocky; very hard, very firm, sticky and plastic; few intersecting slickensides; few fine accumulations of carbonate; slight effervescence; moderately alkaline; clear wavy boundary.

Bky—32 to 42 inches; olive (5Y 5/3) clay, olive gray (5Y 5/2) moist; few fine yellowish brown (10YR 5/6 moist) stains of iron; weak coarse subangular

blocky structure; hard, firm, sticky and plastic; about 30 percent soft fragments of shale; common fine accumulations of carbonate; few fine accumulations of gypsum; slight effervescence; mildly alkaline; gradual wavy boundary.

C—42 to 51 inches; olive gray (5Y 5/2) silty clay, dark gray (5Y 4/1) moist; few fine yellowish brown (10YR 5/6 moist) stains of iron; massive; hard, firm, sticky and plastic; about 55 percent soft fragments of shale; slight effervescence; neutral; gradual wavy boundary.

Cr—51 to 60 inches; light gray (5Y 6/1), soft shale bedrock, dark gray (5Y 4/1) moist; yellowish brown (10YR 5/6 moist) stains of iron.

The thickness of the mollic epipedon ranges from 8 to 20 inches. The depth to soft shale ranges from 40 to more than 60 inches. The depth to carbonate ranges from 0 to 8 inches. Some pedons have a thin surface crust or mulch, and other pedons do not have a Cr horizon.

Owanka Series

The Owanka series consists of deep, well drained soils that formed in clayey sediments. These soils are on terraces and alluvial fans. Permeability is moderately slow. Slopes range from 0 to 3 percent.

Typical pedon of Owanka clay loam, 2,480 feet north and 200 feet east of the southwest corner of sec. 9, T. 1 S., R. 10 E.

A—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark gray (10YR 3/1) moist; moderate medium and fine granular structure; hard, friable, sticky and plastic; neutral; clear smooth boundary.

Bw1—6 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; neutral; clear smooth boundary.

Bw2—13 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and plastic; mildly alkaline; clear wavy boundary.

Bk1—18 to 27 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; few fine accumulations of carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.

Bk2—27 to 35 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable, sticky and plastic; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—35 to 60 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, sticky and plastic; few fine accumulations of carbonate; slight effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 9 to 20 inches. Coarse and medium pebbles are scattered throughout the pedon but make up less than 10 percent, by volume. The depth to free carbonates ranges from 10 to 20 inches. Some pedons have accumulations of gypsum and other salts.

Penrose Series

The Penrose series consists of shallow, well drained, calcareous soils that formed in material weathered from interbedded hard limestone and soft, chalky shale. These soils are on dissected plains. Permeability is moderate. Slopes range from 9 to 60 percent.

Typical pedon of Penrose loam, in an area of Penrose-Rock outcrop complex, 9 to 60 percent slopes, 390 feet north and 850 feet west of the southeast corner of sec. 30, T. 6 S., R. 7 E.

A—0 to 4 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; moderate fine granular structure; soft, very friable, slightly sticky; strong effervescence; mildly alkaline; clear smooth boundary.

C—4 to 15 inches; very pale brown (10YR 7/3) channery loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky; about 20 percent hard, fine and medium fragments of limestone; strong effervescence; moderately alkaline; abrupt smooth boundary.

R—15 to 60 inches; ledges of light gray (10YR 7/2), hard limestone bedrock that are separated by thin bands of soft, chalky shale.

The depth to bedrock ranges from 10 to 20 inches. The ledges of hard limestone range from 2 to 6 inches in thickness. The C horizon contains 15 to 25 percent, by volume, hard fragments of limestone.

Pierre Series

The Pierre series consists of moderately deep, well drained soils that formed in material weathered from soft shale. These soils are on dissected plains and

other plains. Cracks that are 0.5 inch to 2.0 inches wide and several feet long extend into the subsoil during dry periods. Permeability is very slow. Slopes range from 2 to 25 percent.

Typical pedon of Pierre clay, in an area of Samsil-Pierre clays, 15 to 25 percent slopes, 1,400 feet south and 2,000 feet west of the northeast corner of sec. 32, T. 4 S., R. 9 E.

A—0 to 5 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; neutral; clear smooth boundary.

Bw—5 to 19 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; few intersecting slickensides; slight effervescence; neutral; clear wavy boundary.

Bk—19 to 26 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few intersecting slickensides; about 10 percent soft fragments of shale; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—26 to 31 inches; light gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; massive; very hard, very firm, sticky and plastic; about 20 percent soft, fine fragments of shale; strong effervescence; mildly alkaline; clear smooth boundary.

Cr—31 to 60 inches; light gray (5Y 6/1), fractured, soft shale bedrock, dark gray (5Y 4/1) moist; common prominent brownish yellow (10YR 6/6) and dark yellowish brown (10YR 4/6) stains; neutral.

The depth to shale ranges from 20 to 40 inches. The soil contains free carbonates at or near the surface. Salts are common in the shale. The C horizon contains as much as 50 percent, by volume, fragments of shale. Some pedons do not have a C horizon.

Razor Series

The Razor series consists of moderately deep, well drained soils that formed in material weathered from soft shale. These soils are on dissected plains and other plains. Permeability is slow. Slopes range from 2 to 15 percent.

Typical pedon of Razor silty clay, 6 to 9 percent slopes, 1,800 feet south and 1,920 feet east of the northwest corner of sec. 26, T. 4 N., R. 17 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; neutral; clear smooth boundary.

Bw—4 to 15 inches; light yellowish brown (2.5Y 6/4) silty clay, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak fine and medium blocky; hard, firm, sticky and plastic; strong effervescence; moderately alkaline; clear smooth boundary.

Bk—15 to 26 inches; pale olive (5Y 6/3) silty clay, light olive gray (2.5Y 5/4) moist; weak medium blocky structure; hard, firm, sticky and plastic; very few intersecting slickensides; about 10 percent soft, fine fragments of shale; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C—26 to 30 inches; pale olive (5Y 6/3) clay loam, olive (5Y 5/3) moist; massive; hard, firm, sticky and plastic; about 40 percent soft, fine and medium fragments of shale; few medium accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—30 to 60 inches; light gray (5Y 7/2), soft shale bedrock, olive gray (5Y 5/2) moist; strong effervescence; moderately alkaline.

The depth to soft shale ranges from 20 to 40 inches. The depth to carbonate ranges from 0 to 4 inches. The A horizon is dominantly silty clay but in some pedons is silty clay loam. The B horizon is silty clay or silty clay loam.

Samsil Series

The Samsil series consists of shallow, well drained soils that formed in material weathered from soft shale. These soils are on dissected plains. Permeability is slow. Slopes range from 15 to 60 percent.

Typical pedon of Samsil clay, 25 to 40 percent slopes, 1,515 feet east and 1,120 feet south of the northwest corner of sec. 12, T. 1 N., R. 14 E.

A—0 to 2 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; about 10 percent soft, fine fragments of shale; slight effervescence; mildly alkaline; clear wavy boundary.

AC—2 to 7 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak medium granular; hard, friable, sticky and plastic; about 10 percent soft, fine fragments of shale; slight effervescence; mildly alkaline; clear wavy boundary.

C1—7 to 11 inches; light brownish gray (2.5Y 6/2) clay,

grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and plastic; about 30 percent soft, fine and medium fragments of shale; few fine distinct olive yellow (2.5Y 6/6) stains; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—11 to 17 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; massive; hard, friable, sticky and plastic; about 50 percent soft, medium and coarse fragments of shale; common distinct olive yellow (2.5Y 6/6) stains; few fine and medium accumulations of carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.

Cr—17 to 60 inches; light gray (5Y 7/2), soft shale bedrock, olive gray (5Y 5/2) moist; soft when moist but hard and brittle when dry; few stains of iron and manganese.

The depth to soft shale ranges from 6 to 20 inches. The C horizon and the upper part of the Cr horizon commonly have accumulations of carbonate, gypsum, and other salts. The A horizon is dominantly clay but in some pedons is silty clay. The AC horizon contains as much as 30 percent, by volume, soft fragments of shale. The C horizon contains from 35 to more than 60 percent, by volume, soft fragments of shale.

Satanta Series

The Satanta series consists of deep, well drained soils that formed in loamy alluvium. These soils are on high terraces. Permeability is moderate. Slopes range from 0 to 9 percent.

Typical pedon of Satanta loam, 0 to 2 percent slopes, 2,200 feet north and 760 feet east of the southwest corner of sec. 24, T. 1 N., R. 14 E.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; soft, friable; neutral; clear smooth boundary.

BA—6 to 11 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

Bt—11 to 22 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

Bk—22 to 27 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; strong effervescence; moderately alkaline; gradual wavy boundary.

C—27 to 60 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 8 to 18 inches. The depth to free carbonates ranges from 18 to 30 inches. The A horizon is dominantly loam but in some pedons is fine sandy loam.

Savo Series

The Savo series consists of deep, well drained soils that formed in silty sediments. These soils are on dissected plains and other plains. Permeability is moderately slow. Slopes range from 0 to 9 percent.

Typical pedon of Savo silt loam, 0 to 2 percent slopes, 130 feet south and 2,490 feet east of the northwest corner of sec. 29, T. 6 S., R. 8 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; neutral; clear wavy boundary.

Bt1—4 to 8 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; neutral; clear wavy boundary.

Bt2—8 to 14 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; neutral; clear wavy boundary.

Bk1—14 to 23 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk2—23 to 42 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; diffuse wavy boundary.

C—42 to 60 inches; brown (10YR 5/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable, sticky and plastic; strong effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 7 to 14 inches. The depth to free carbonates ranges from 14 to 20 inches.

Schamber Series

The Schamber series consists of deep, excessively drained soils that formed in sandy and gravelly outwash sediments. These soils are on terraces. Permeability is rapid. Slopes range from 15 to 40 percent.

Typical pedon of Schamber gravelly loam, in an area of Schamber-Samsil complex, 15 to 40 percent slopes, 2,300 feet north and 740 feet east of the southwest corner of sec. 7, T. 2 S., R. 15 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear wavy boundary.

C1—4 to 11 inches; yellowish brown (10YR 5/4) very gravelly sand, yellowish brown (10YR 5/4) moist; single grain; loose; about 35 percent gravel; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—11 to 60 inches; light yellowish brown (10YR 6/4) very gravelly sand, yellowish brown (10YR 5/4) moist; single grain; loose; about 55 percent gravel; coatings of carbonate on the underside of gravel; strong effervescence; moderately alkaline.

The control section contains 35 to 60 percent, by volume, gravel. The depth to free carbonates ranges from 2 to 6 inches, but some pedons are noncalcareous.

Shingle Series

The Shingle series consists of shallow, well drained soils that formed in material weathered from soft, interbedded sandstone and shale. These soils are on dissected plains. Permeability is moderate. Slopes range from 9 to 60 percent.

Typical pedon of Shingle loam, 15 to 25 percent slopes, 600 feet south and 1,040 feet east of the northwest corner of sec. 34, T. 3 N., R. 15 E.

A—0 to 3 inches; yellow (10YR 7/6) loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—3 to 14 inches; yellow (10YR 7/6) loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable; about 20 percent soft, fine and medium fragments of shale; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—14 to 60 inches; very pale brown (10YR 7/3) and yellow (2.5Y 7/6), soft, interbedded sandy shale and sandstone bedrock, brownish yellow (10YR 6/6) and light brownish gray (2.5Y 6/2) moist; strong effervescence; moderately alkaline.

The depth to soft bedrock is 10 to 20 inches. Typically, the soils are calcareous throughout, but some pedons are leached to a depth of a few inches. The control section contains 0 to 25 percent, by volume, soft fragments of shale and sandstone. The C horizon is loam, clay loam, or silty clay loam.

Swanboy Series

The Swanboy series consists of deep, well drained soils that formed in clayey alluvium. These soils are on alluvial fans. Cracks that are 0.5 inch to 2.0 inches wide and several feet long extend into the subsoil during dry periods. Permeability is very slow. Slopes range from 0 to 6 percent.

Typical pedon of Swanboy clay, 0 to 6 percent slopes, 1,700 feet north and 1,400 feet east of the southwest corner of sec. 9, T. 2 S., R. 12 E.

A—0 to 1 inch; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate medium granular structure; hard, friable, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bw—1 to 5 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak coarse subangular blocky structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; slight effervescence; mildly alkaline; clear wavy boundary.

Bz—5 to 17 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak coarse blocky structure; extremely hard, very firm, sticky and plastic; few intersecting slickensides; common fine accumulations of salts; slight effervescence; moderately alkaline; gradual wavy boundary.

C—17 to 60 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; very hard, very firm, very sticky and very plastic; few fine accumulations of carbonate and salts; slight effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 16 inches. Visible salts are within a depth of 10 inches.

Tilford Series

The Tilford series consists of deep, well drained soils that formed in silty sediments. These soils are on terraces. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Tilford silt loam, 0 to 2 percent

slopes, 1,260 feet south and 260 feet east of the northwest corner of sec. 29, T. 6 S., R. 7 E.

A—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; neutral; clear wavy boundary.

Bw1—7 to 12 inches; reddish brown (5YR 5/3) silt loam, reddish brown (5YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; slight effervescence; moderately alkaline; clear wavy boundary.

Bw2—12 to 17 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; clear wavy boundary.

Bk—17 to 29 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 4/4) moist; weak medium blocky structure; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—29 to 60 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable; common fine accumulations of carbonate and salts; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 15 inches. The depth to free carbonates ranges from 0 to 10 inches. The Bw horizon is silt loam or silty clay loam. In some pedons silty shale bedrock is below a depth of 40 inches.

Valent Series

The Valent series consists of deep, excessively drained soils that formed in sandy eolian sediments. These soils are on dissected plains and other plains. Permeability is rapid. Slopes range from 2 to 25 percent.

Typical pedon of Valent loamy fine sand, 6 to 25 percent slopes, 1,870 feet south and 840 feet west of the northeast corner of sec. 26, T. 6 S., R. 9 E.

A—0 to 4 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; single grain; loose; neutral; clear smooth boundary.

C—4 to 60 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grain; loose; neutral.

The depth to carbonate ranges from 40 to more than 60 inches. The A horizon is loamy fine sand or fine sand.

Wanblee Series

The Wanblee series consists of moderately deep, well drained, sodium-affected soils that formed in material weathered from soft mudstone. These soils are on plains. Permeability is very slow. Slopes range from 0 to 4 percent.

Typical pedon of Wanblee silt loam, 0 to 4 percent slopes, 2,050 feet north and 200 feet east of the southwest corner of sec. 7, T. 4 S., R. 16 E.

E—0 to 3 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium and thin platy structure; soft, friable; neutral; abrupt smooth boundary.

Bt—3 to 8 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to moderate medium and fine blocky; very hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

Bk—8 to 16 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate fine and medium blocky; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—16 to 29 inches; white (10YR 8/1) clay loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—29 to 60 inches; light gray (5Y 7/2), soft mudstone bedrock, light olive gray (5Y 6/2) moist; strong effervescence.

The depth to soft mudstone ranges from 20 to 40 inches. The depth to free carbonates ranges from 6 to 10 inches. The E horizon is dominantly silt loam but in some pedons is loam.

Weta Series

The Weta series consists of deep, well drained, sodium-affected soils that formed in sodium-rich, clayey and silty sediments. These soils are on alluvial fans. Permeability is very slow in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 3 percent.

Typical pedon of Weta silt loam, in an area of Cactusflat-Weta complex, 500 feet north and 450 feet

west of the southeast corner of sec. 26, T. 2 S., R. 16 E.

E—0 to 3 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak very fine granular; soft, friable; medium acid; abrupt smooth boundary.

Bt1—3 to 6 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to moderate medium and fine blocky; very hard, very firm, sticky and plastic; light brownish gray (10YR 6/2) coatings on top of columns; neutral; clear wavy boundary.

Bt2—6 to 12 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine blocky; very hard, very firm, sticky and plastic; strong effervescence; mildly alkaline; clear wavy boundary.

Bkz—12 to 21 inches; brown (10YR 5/3) silty clay loam, grayish brown (10YR 5/2) moist; weak medium and fine blocky structure; hard, firm, sticky and plastic; few fine accumulations of carbonate and salts; violent effervescence; moderately alkaline; gradual wavy boundary.

C1—21 to 28 inches; pale brown (10YR 6/3) silty clay loam, grayish brown (10YR 5/2) moist; weak medium and fine subangular blocky structure; hard, friable, sticky and plastic; common fine accumulations of carbonate and salts; violent effervescence; moderately alkaline; diffuse wavy boundary.

C2—28 to 60 inches; light gray (10YR 7/2), stratified silt loam and loam, brown (10YR 5/3) moist; massive; weak bedding planes; hard, friable; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 12 inches. The depth to free carbonates ranges from 0 to 8 inches. The E horizon is dominantly silt loam but in some pedons is loam. The Bt horizon is clay or silty clay. Mudstone bedrock is below a depth of 40 inches in some pedons.

Whitelake Series

The Whitelake series consists of deep, moderately well drained, sodium-affected soils that formed in loamy and sandy alluvial sediments. These soils are in closed depressions on plains. Permeability is slow in the subsoil and moderate in the underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Whitelake fine sandy loam, 450 feet north and 350 feet west of the southeast corner of sec. 2, T. 6 S., R. 9 E.

A—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure parting to single grain; soft, very friable; slightly acid; clear smooth boundary.

E—7 to 10 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to weak very fine granular; soft, very friable; slight effervescence; neutral; abrupt smooth boundary.

Btk1—10 to 14 inches; light brownish gray (10YR 6/2) sandy clay loam, brown (10YR 4/3) moist; strong medium and coarse columnar structure parting to weak medium subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few medium accumulations of carbonate; strong effervescence; strongly alkaline; clear wavy boundary.

Btk2—14 to 19 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; very strongly alkaline; clear wavy boundary.

BC—19 to 27 inches; grayish brown (10YR 5/2) sandy clay loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure parting to moderate medium subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate and salts; strong effervescence; very strongly alkaline; gradual wavy boundary.

C1—27 to 41 inches; very pale brown (10YR 8/3) fine sandy loam, light brownish gray (10YR 6/2) moist; thin strata of finer textured material; massive; soft, very friable; violent effervescence; very strongly alkaline; diffuse wavy boundary.

C2—41 to 60 inches; brownish yellow (10YR 6/6) loamy fine sand, yellowish brown (10YR 5/6) moist; few fine distinct very pale brown (10YR 7/3) mottles; thin strata of finer textured material; massive; soft, very friable; slight effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to free carbonates ranges from 7 to 35 inches.

Whitewater Series

The Whitewater series consists of moderately deep, well drained, calcareous soils that formed in sodium-rich

material weathered from soft mudstone. These soils are on dissected plains and other plains. Cracks that are 0.5 inch to 2.0 inches wide and several feet long extend into the subsoil during dry periods. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Whitewater clay, 0 to 3 percent slopes, 300 feet south and 1,050 feet east of the northwest corner of sec. 22, T. 3 S., R. 16 E.

A—0 to 3 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak fine blocky structure parting to weak very fine and fine granular; slightly hard, firm, sticky and plastic; cracks 0.5 to 1.0 inch wide; strong effervescence; mildly alkaline; clear smooth boundary.

Bw—3 to 16 inches; gray (10YR 6/1) clay, gray (10YR 5/1) moist; weak coarse subangular blocky structure parting to weak medium subangular blocky; extremely hard, very firm, sticky and plastic; few intersecting slickensides; strong effervescence; moderately alkaline; clear smooth boundary.

BC—16 to 26 inches; gray (10YR 6/1) clay, gray (10YR 5/1) moist; massive; extremely hard, very firm, sticky and plastic; few intersecting slickensides; few medium accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C—26 to 33 inches; light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; massive; extremely hard, very firm, sticky and plastic; few intersecting slickensides; few medium accumulations of carbonate; strong effervescence; mildly alkaline; diffuse wavy boundary.

Cr—33 to 60 inches; pinkish gray (7.5YR 7/2), soft mudstone bedrock, pinkish gray (7.5YR 6/2) moist; soft when moist but hard and brittle when dry; slight effervescence; mildly alkaline.

The depth to bedrock ranges from 20 to 40 inches. The soils contain free carbonates throughout. They have an SAR of 10 to 20 in the subsoil and an SAR of 15 to 25 in the C horizon. The A horizon is dominantly clay but in some pedons is silty clay. In some pedons the BC horizon has few or common accumulations of salts.

Wortman Series

The Wortman series consists of moderately deep, well drained, sodium-affected soils that formed in material weathered from soft mudstone. These soils are on plains. Permeability is very slow. Slopes range from 0 to 6 percent.

Typical pedon of Wortman silt loam, 0 to 6 percent slopes, 100 feet north and 300 feet west of the southeast corner of sec. 2, T. 2 S., R. 15 E.

E—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bt1—5 to 10 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to moderate medium blocky; hard, firm, sticky and plastic; neutral; clear smooth boundary.

Bt2—10 to 17 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

Bk—17 to 34 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; hard, firm, slightly sticky; few fine accumulations of carbonate; strong effervescence; moderately alkaline; diffuse wavy boundary.

Cr—34 to 60 inches; light gray (10YR 7/2), soft mudstone bedrock, grayish brown (10YR 5/2) moist; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 13 inches. The depth to bedrock ranges from 20 to 40 inches. Some pedons have an A horizon. Some pedons have a C horizon. The Cr horizon is soft mudstone or interbedded, soft sandstone and shale.

Zigweid Series

The Zigweid series consists of deep, well drained soils that formed in loamy alluvium. These soils are on high terraces. Permeability is moderate. Slopes range from 6 to 15 percent.

The Zigweid soils are taxadjuncts to the series because they have a mollic epipedon and are leached of carbonates to a greater depth. These differences, however, do not affect the use or management of the soils.

Typical pedon of Zigweid loam, in an area of Zigweid-Nihill complex, 6 to 15 percent slopes, 600 feet north and 30 feet west of the southeast corner of sec. 12, T. 1 N., R. 8 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

Bw—4 to 10 inches; brown (10YR 4/3) loam, dark

brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

Bk—10 to 16 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—16 to 60 inches; light brownish gray (10YR 6/2) clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; about 15 percent fragments of gravel; few medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

The thickness of the mollic epipedon ranges from 7 to 10 inches. The depth to carbonate ranges from 6 to 12 inches. The Bw horizon is clay loam or loam. The C horizon has 5 to 15 percent, by volume, gravel. In some pedons soft shale bedrock is at a depth of 40 to 60 inches.

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Glossary

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hill slopes. Back slopes are commonly steep and linear and descend to a foot slope. They are erosional forms produced mainly by mass wasting and running water.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount

of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes recognized in this survey are:

Deep	more than 40 inches
Moderately deep	20 to 40 inches
Shallow	less than 20 inches

Depth to bedrock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer,

excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Mollic epipedon. A thick, dark, humus-rich surface horizon or (horizons) that has high base saturation and pedogenic soil structure. It may include part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder slope. The uppermost inclined surface at the top of a hill slope. Shoulders are transition zones from back slopes to a summit in upland areas. They dominantly are convex in profile and erosional in origin.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey area are as follows:

Level	0 to 1 percent
Nearly level	0 to 3 percent
Very gently sloping or gently undulating	0 to 4 percent
Gently sloping or undulating	2 to 6 percent
Moderately sloping or gently rolling	6 to 9 percent
Strongly sloping or rolling	9 to 15 percent
Moderately steep or hilly	15 to 25 percent
Steep or very hilly	25 to 45 percent
Very steep	more than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded and 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive*

(the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. The top or highest level of an upland feature A high interfluve area that has gentler slopes and that is flanked by steeper hill slopes.

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Wasta, South Dakota)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	33.1	7.2	20.2	65	-29	26	0.35	0.10	0.54	1	5.0
February----	39.1	13.1	26.1	71	-21	34	.44	.17	.66	2	5.8
March-------	47.4	21.2	34.3	79	-12	93	.82	.20	1.31	2	7.3
April-------	61.3	33.2	47.3	88	12	250	1.90	.70	2.89	4	3.8
May---------	72.2	44.0	58.1	94	25	561	2.54	1.23	3.66	6	.1
June--------	82.2	53.8	68.0	103	37	840	3.05	1.38	4.48	6	.0
July--------	90.5	59.4	75.0	108	44	1,085	2.08	.96	3.03	4	.0
August------	88.8	57.2	73.0	106	41	1,023	1.48	.48	2.29	4	.0
September---	78.6	46.0	62.3	101	26	669	1.06	.22	1.73	2	.0
October-----	66.0	34.6	50.3	92	14	332	.94	.26	1.49	2	1.4
November----	48.7	21.8	35.3	76	-4	56	.49	.13	.78	1	4.0
December----	37.4	12.1	24.8	65	-21	24	.38	.08	.61	2	4.7
Yearly:											
Average---	62.1	33.6	47.9	---	---	---	---	---	---	---	---
Extreme---	---	---	---	108	-29	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,993	15.53	12.75	18.03	36	32.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Wasta, South Dakota)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 10	May 15	May 25
2 years in 10 later than--	May 4	May 10	May 20
5 years in 10 later than--	Apr. 21	Apr. 29	May 10
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 3	Sept. 20	Sept. 9
2 years in 10 earlier than--	Oct. 9	Sept. 25	Sept. 14
5 years in 10 earlier than--	Oct. 19	Oct. 4	Sept. 24

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Wasta, South Dakota)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	157	138	116
8 years in 10	165	144	123
5 years in 10	181	157	137
2 years in 10	198	171	152
1 year in 10	208	179	161

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Custer County	Pennington County	Total-- Area	Extent
		Acres	Acres	Acres	Pct
AaA	Altvan loam, 0 to 2 percent slopes	650	4,190	4,840	0.3
AaB	Altvan loam, 2 to 6 percent slopes	490	1,370	1,860	0.1
AaC	Altvan loam, 6 to 9 percent slopes	430	830	1,260	0.1
ArA	Arvada loam, 0 to 4 percent slopes	4,680	12,550	17,230	1.1
BaA	Baca silt loam, 0 to 4 percent slopes	2,310	2,730	5,040	0.3
Bb	Badland	3,990	60,370	64,360	4.0
BcB	Bankard loamy fine sand, 0 to 4 percent slopes	4,360	8,220	12,580	0.8
BfA	Beckton silt loam, 0 to 4 percent slopes	680	13,600	14,280	0.9
BhA	Beckton-Arvada complex, 0 to 4 percent slopes	80	3,260	3,340	0.2
BkA	Blackpipe silty clay loam, 0 to 2 percent slopes	0	4,540	4,540	0.3
BkB	Blackpipe silty clay loam, 2 to 6 percent slopes	0	8,110	8,110	0.5
BlA	Blackpipe clay loam, 0 to 2 percent slopes	1,650	1,160	2,810	0.2
BlB	Blackpipe clay loam, 2 to 6 percent slopes	6,310	4,700	11,010	0.7
BnC	Blackpipe-Norrest complex, 6 to 12 percent slopes	1,390	5,970	7,360	0.5
BoA	Blackpipe-Wortman complex, 0 to 3 percent slopes	0	21,160	21,160	1.3
BoB	Blackpipe-Wortman complex, 1 to 6 percent slopes	350	5,010	5,360	0.3
Bp	Bridgeport silt loam	0	2,760	2,760	0.2
Ca	Cactusflat silty clay	0	1,880	1,880	0.1
Cb	Cactusflat-Weta complex	0	3,570	3,570	0.2
CeA	Cedarpass silty clay loam, 0 to 3 percent slopes	0	16,900	16,900	1.0
CfA	Cedarpass-Denby complex, 0 to 3 percent slopes	120	15,920	16,040	1.0
Ch	Cedarpass-Interior-Badland complex	0	20,580	20,580	1.3
ClF	Colby silt loam, 9 to 40 percent slopes	410	2,020	2,430	0.2
CmC	Colby-Norka silt loams, 6 to 15 percent slopes	3,860	1,050	4,910	0.3
Cn	Colombo loam	3,710	2,540	6,250	0.4
Co	Colombo loam, channeled	1,670	1,490	3,160	0.2
Cp	Colombo-Urban land complex	0	1,080	1,080	0.1
CuD	Conata-Hisle complex, 6 to 25 percent slopes	680	5,200	5,880	0.4
CyC	Cushman loam, 6 to 9 percent slopes	0	7,240	7,240	0.4
CzD	Cushman-Shingle loams, 9 to 15 percent slopes	0	13,460	13,460	0.8
DmA	Denby silty clay, 0 to 3 percent slopes	210	2,980	3,190	0.2
Eg	Egas silty clay loam	20	2,960	2,980	0.2
EmA	Emigrant loam, 0 to 2 percent slopes	4,960	1,720	6,680	0.4
EmB	Emigrant loam, 2 to 6 percent slopes	9,750	6,490	16,240	1.0
EnD	Enning-Minnequa silt loams, 9 to 25 percent slopes	4,870	2,210	7,080	0.4
FaE	Fairburn clay loam, 9 to 40 percent slopes	25,200	12,390	37,590	2.3
FgE	Fairburn gravelly clay loam, 15 to 45 percent slopes, bouldery	6,360	750	7,110	0.4
FhE	Fairburn-Badland complex, 9 to 40 percent slopes	1,260	2,060	3,320	0.2
FoF	Fairburn-Orella-Badland complex, 15 to 45 percent slopes	19,260	7,210	26,470	1.6
Gb	Glenberg fine sandy loam	1,490	3,090	4,580	0.3
GrE	Grummit-Rock outcrop complex, 6 to 40 percent slopes	3,990	4,310	8,300	0.5
GsD	Grummit-Urban land complex, 9 to 30 percent slopes	0	480	480	*
Ha	Haverson silt loam	1,930	3,820	5,750	0.4
Hc	Haverson loam, channeled	3,380	210	3,590	0.2
HpB	Hisle silt loam, 0 to 6 percent slopes	620	9,890	10,510	0.6
HrC	Hisle-Rock outcrop complex, 2 to 9 percent slopes	0	2,200	2,200	0.1
HsB	Hisle-Slickspots complex, 0 to 6 percent slopes	30	2,900	2,930	0.2
Hv	Hoven silt loam	130	3,940	4,070	0.3
Hz	Hoven Variant silty clay, ponded	0	460	460	*
In	Interior loam	0	3,890	3,890	0.2
Io	Interior loam, channeled	400	16,950	17,350	1.1
IrB	Interior-Cedarpass-Denby complex, 0 to 6 percent slopes	270	18,340	18,610	1.2
JaA	Jayem fine sandy loam, 0 to 3 percent slopes	2,220	3,170	5,390	0.3
JaC	Jayem fine sandy loam, 3 to 9 percent slopes	4,050	5,240	9,290	0.6
KtA	Kyle clay, 0 to 1 percent slopes	0	2,780	2,780	0.2
KyA	Kyle clay, 0 to 3 percent slopes	7,910	11,600	19,510	1.2
KyB	Kyle clay, 3 to 6 percent slopes	6,170	20,080	26,250	1.6
KyC	Kyle clay, 6 to 9 percent slopes	1,080	6,660	7,740	0.5
LaB	Larvie clay, 0 to 4 percent slopes	0	1,410	1,410	0.1
LaD	Larvie clay, 6 to 15 percent slopes	0	980	980	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Custer County	Pennington County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
LhC	Larvie-Hisle complex, 0 to 9 percent slopes	0	5,030	5,030	0.3
Lo	Lohmiller silty clay	3,850	11,920	15,770	1.0
Lp	Lohmiller silty clay, channeled	10,780	20,810	31,590	2.0
MaB	Manvel silt loam, 0 to 6 percent slopes	1,930	1,930	3,860	0.2
MeC	Manvel-Minnequa silt loams, 2 to 9 percent slopes	3,160	1,830	4,990	0.3
MgC	Manvel-Urban land complex, 6 to 15 percent slopes	0	680	680	*
MoE	Midway silty clay loam, 15 to 40 percent slopes	430	33,270	33,700	2.1
MosE	Midway clay loam, 15 to 40 percent slopes, stony	9,780	2,900	12,680	0.8
MpD	Midway-Urban land complex, 9 to 30 percent slopes	0	290	290	*
MrC	Minnequa-Penrose complex, 6 to 9 percent slopes	1,730	0	1,730	0.1
NdE	Nihill gravelly loam, 9 to 40 percent slopes	3,800	6,250	10,050	0.6
NeD	Nihill very gravelly loam, 0 to 25 percent slopes	80	590	670	*
NgA	Norka silt loam, 0 to 2 percent slopes	1,390	1,620	3,010	0.2
NgB	Norka silt loam, 2 to 6 percent slopes	3,070	1,240	4,310	0.3
NhA	Norka-Weta silt loams, 0 to 3 percent slopes	70	4,050	4,120	0.3
NkD	Norrest silty clay loam, 6 to 15 percent slopes	16,790	4,760	21,550	1.3
NuA	Nunn loam, 0 to 2 percent slopes	16,010	40,470	56,480	3.5
NuB	Nunn loam, 2 to 6 percent slopes	8,160	61,730	69,890	4.3
NuC	Nunn loam, 6 to 12 percent slopes	860	16,920	17,780	1.1
NvA	Nunn-Beckton complex, 0 to 3 percent slopes	2,290	9,570	11,860	0.7
NvC	Nunn-Beckton complex, 3 to 9 percent slopes	30	3,380	3,410	0.2
NwA	Nunn-Urban land complex, 0 to 3 percent slopes	0	2,470	2,470	0.2
ObE	Orella-Badland complex, 9 to 45 percent slopes	80	23,930	24,010	1.5
OeE	Orella-Interior-Badland complex, 0 to 25 percent slopes	0	5,920	5,920	0.4
OtA	Ottumwa clay, 0 to 2 percent slopes	0	6,680	6,680	0.4
OtB	Ottumwa clay, 2 to 6 percent slopes	0	19,250	19,250	1.2
OvC	Ottumwa-Razor complex, 6 to 9 percent slopes	0	7,630	7,630	0.5
Ow	Owanka clay loam	3,130	11,680	14,810	0.9
Ox	Owanka-Beckton complex	4,460	4,040	8,500	0.5
PdF	Penrose-Rock outcrop complex, 9 to 60 percent slopes	2,670	0	2,670	0.2
PeB	Pierre clay, 2 to 6 percent slopes	11,590	8,170	19,760	1.2
PeC	Pierre clay, 6 to 9 percent slopes	80	11,320	11,400	0.7
PeD	Pierre clay, 6 to 15 percent slopes	19,680	33,400	53,080	3.3
PgD	Pierre-Grummit clays, 6 to 15 percent slopes	2,900	2,860	5,760	0.4
PhB	Pierre-Hisle complex, 0 to 9 percent slopes	4,110	11,310	15,420	1.0
PkC	Pierre-Urban land complex, 6 to 15 percent slopes	0	1,810	1,810	0.1
Ps	Pits, gravel	30	1,300	1,330	0.1
RaB	Razor silty clay, 2 to 6 percent slopes	180	3,660	3,840	0.2
RaC	Razor silty clay, 6 to 9 percent slopes	20	3,950	3,970	0.2
RbD	Razor-Midway complex, 6 to 15 percent slopes	910	32,090	33,000	2.0
Rv	Riverwash	780	3,560	4,340	0.3
SbF	Samsil clay, 25 to 40 percent slopes	18,052	88,397	106,449	6.6
ScE	Samsil-Pierre clays, 15 to 25 percent slopes	23,270	62,588	85,858	5.3
SdF	Samsil-Rock outcrop complex, 25 to 75 percent slopes	2,460	25,760	28,220	1.7
SeA	Satanta loam, 0 to 2 percent slopes	6,150	38,910	45,060	2.8
SeB	Satanta loam, 2 to 6 percent slopes	3,460	28,730	32,190	2.0
SeC	Satanta loam, 6 to 9 percent slopes	270	3,770	4,040	0.3
SgA	Satanta-Beckton complex, 0 to 3 percent slopes	1,740	9,100	10,840	0.7
SkA	Satanta-Urban land complex, 0 to 2 percent slopes	0	1,240	1,240	0.1
SkB	Satanta-Urban land complex, 2 to 6 percent slopes	0	1,140	1,140	0.1
SmA	Savo silt loam, 0 to 2 percent slopes	5,460	3,670	9,130	0.6
SmB	Savo silt loam, 2 to 6 percent slopes	4,370	10,380	14,750	0.9
SmC	Savo silt loam, 6 to 9 percent slopes	560	5,340	5,900	0.4
SoB	Savo-Urban land complex, 0 to 9 percent slopes	0	430	430	*
StE	Schamber-Samsil complex, 15 to 40 percent slopes	3,460	6,840	10,300	0.6
SuE	Shingle loam, 15 to 25 percent slopes	0	8,170	8,170	0.5
SvF	Shingle-Rock outcrop complex, 25 to 60 percent slopes	0	10,300	10,300	0.6
SzB	Swanboy clay, 0 to 6 percent slopes	900	2,200	3,100	0.2
TfA	Tilford silt loam, 0 to 2 percent slopes	460	0	460	*
VbD	Valent loamy fine sand, 6 to 25 percent slopes	1,650	3,160	4,810	0.3
VbwB	Valent-Wortman loamy fine sands, 2 to 6 percent slopes	0	1,160	1,160	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Custer County	Pennington County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
WaA	Wanblee silt loam, 0 to 4 percent slopes	570	2,470	3,040	0.2
WbB	Wanblee-Wortman silt loams, 0 to 4 percent slopes	450	17,230	17,680	1.1
WeA	Weta silt loam, 0 to 3 percent slopes	0	1,460	1,460	0.1
Wh	Whitelake fine sandy loam	480	450	930	0.1
WkA	Whitewater clay, 0 to 3 percent slopes	350	9,070	9,420	0.6
WoB	Whitewater-Orella clays, 3 to 9 percent slopes	60	24,450	24,510	1.5
WwB	Wortman silt loam, 0 to 6 percent slopes	1,620	3,810	5,430	0.3
ZnD	Zigweid-Nihill complex, 6 to 15 percent slopes	5,290	36,150	41,440	2.6
	Water	1,670	7,030	8,700	0.5
	Total	360,962	1,252,305	1,613,267	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass	Winter wheat	Grain sorghum
	Bu	Tons	AUM*	Bu	Bu
AaA----------------------- Altvan	29	1.3	2.1	28	25
AaB----------------------- Altvan	27	1.2	2.0	26	24
AaC----------------------- Altvan	---	---	2.0	---	---
ArA. Arvada					
BaA----------------------- Baca	28	1.2	2.1	27	24
Bb**. Badland					
BcB. Bankard					
BfA----------------------- Beckton	22	1.0	1.6	21	20
BhA. Beckton-Arvada					
BkA----------------------- Blackpipe	39	1.7	2.9	38	35
BkB----------------------- Blackpipe	37	1.6	2.7	36	32
BlA----------------------- Blackpipe	35	1.5	2.6	33	32
BlB----------------------- Blackpipe	35	1.5	2.4	32	32
BnC----------------------- Blackpipe-Norrest	22	1.0	1.6	22	20
BoA----------------------- Blackpipe-Wortman	30	1.3	2.2	29	27
BoB----------------------- Blackpipe-Wortman	27	1.2	2.0	26	24
Bp------------------------ Bridgeport	35	1.5	2.6	24	31
Ca------------------------ Cactusflat	31	1.4	2.3	30	27
Cb------------------------ Cactusflat-Weta	23	1.0	1.7	22	20

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass	Winter wheat	Grain sorghum
	Bu	Tons	AUM*	Bu	Bu
CeA: Cedarpass	30	1.3	2.2	39	26
CfA: Cedarpass-Denby	31	1.4	2.3	30	27
Ch**. Cedarpass-Interior-Badland					
ClF. Colby					
CmC. Colby-Norka					
Cn: Colombo	46	2.0	3.4	45	41
Co. Colombo					
Cp**. Colombo-Urban land					
CuD. Conata-Hisle					
CyC: Cushman	28	1.2	2.0	27	25
CzD. Cushman-Shingle					
DmA: Denby	32	1.4	2.3	31	28
Eg. Egas					
EmA: Emigrant	34	1.5	2.5	33	30
EmB: Emigrant	31	1.4	2.3	30	27
EnD. Enning-Minnequa					
FaE, FgE. Fairburn					
FhE**. Fairburn-Badland					
FoF**. Fairburn-Orella-Badland					

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass	Winter wheat	Grain sorghum
	Bu	Tons	AUM*	Bu	Bu
Gb------------------------ Glenberg	30	1.3	2.2	29	26
GrE**. Grummit-Rock outcrop					
GsD**. Grummit-Urban land					
Ha------------------------ Haverson	32	1.4	2.3	30	28
Hc------------------------ Haverson	---	1.5	2.5	---	---
HpB. Hisle					
HrC**. Hisle-Rock outcrop					
HsB**. Hisle-Slickspots					
Hv. Hoven					
Hz. Hoven Variant					
In, Io. Interior					
IrB. Interior-Cedarpass-Denby					
JaA----------------------- Jayem	32	1.5	---	34	---
JaC----------------------- Jayem	21	1.4	---	31	---
KtA, KyA------------------ Kyle	32	1.4	2.4	31	29
KyB----------------------- Kyle	31	1.4	2.3	30	27
KyC----------------------- Kyle	29	1.3	2.2	28	25
LaB----------------------- Larvie	25	1.1	1.8	21	21
LaD. Larvie					
LhC. Larvie-Hisle					

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass	Winter wheat	Grain sorghum
	Bu	Tons	AUM*	Bu	Bu
Lo------------------------ Lohmiller	34	1.5	2.5	33	30
Lp------------------------ Lohmiller	---	1.7	2.8	---	---
MaB----------------------- Manvel	26	1.1	1.9	25	23
MeC. Manvel-Minnequa					
MgC**. Manvel-Urban land					
MoE, MosE. Midway					
MpD**. Midway-Urban land					
MrC. Minnequa-Penrose					
NdE, NeD. Nihill					
NgA----------------------- Norka	35	1.6	2.6	34	31
NgB----------------------- Norka	33	1.5	2.4	32	29
NhA----------------------- Norka-Weta	25	1.2	1.9	25	23
NkD. Norrest					
NuA----------------------- Nunn	34	1.5	2.5	33	30
NuB----------------------- Nunn	31	1.4	2.3	30	27
NuC----------------------- Nunn	28	1.2	2.0	27	25
NvA----------------------- Nunn-Beckton	29	1.3	2.1	28	26
NvC----------------------- Nunn-Beckton	21	0.9	1.5	20	18
NwA**. Nunn-Urban land					
ObE**. Orella-Badland					

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass	Winter wheat	Grain sorghum
	Bu	Tons	AUM*	Bu	Bu
OeE**. Orella-Interior-Badland					
OtA----------------------- Ottumwa	35	1.5	2.6	34	31
OtB----------------------- Ottumwa	34	1.5	2.5	33	38
OvC----------------------- Ottumwa-Razor	29	1.3	2.2	28	26
Ow------------------------ Owanka	36	1.6	2.7	35	32
Ox------------------------ Owanka	30	1.4	2.3	29	27
PdF**. Penrose-Rock outcrop					
PeB, PeC------------------ Pierre	27	1.2	2.0	26	24
PeD. Pierre					
PgD. Pierre-Grummit					
PhB. Pierre-Hisle					
PkC**. Pierre-Urban land					
Ps**. Pits					
RaB----------------------- Razor	30	1.3	2.2	29	26
RaC----------------------- Razor	25	1.1	1.8	24	22
RbD. Razor-Midway					
Rv**. Riverwash					
SbF. Samsil					
ScE. Samsil-Pierre					
SdF**. Samsil-Rock outcrop					

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass	Winter wheat	Grain sorghum
	Bu	Tons	AUM*	Bu	Bu
SeA Satanta	37	1.6	2.8	36	33
SeB Satanta	30	1.5	2.6	34	31
SeC Satanta	32	1.4	2.3	31	28
SgA Satanta-Beckton	31	1.4	2.3	30	28
SkA**, SkB**. Satanta-Urban land					
SmA Savo	39	1.7	2.9	38	35
SmB Savo	32	1.4	2.3	31	28
SmC Savo	21	0.9	1.5	20	18
SoB**. Savo-Urban land					
StE. Schamber-Samsil					
SuE. Shingle					
SvF**. Shingle-Rock outcrop					
SzB. Swanboy					
TfA Tilford	39	1.7	2.9	38	35
VbD. Valent					
VbwB. Valent-Wortman					
WaA. Wanblee					
WbB. Wanblee-Wortman					
WeA. Weta					
Wh Whitelake	30	0.9	2.0	27	25

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass	Winter wheat	Grain sorghum
	Bu	Tons	AUM*	Bu	Bu
WkA. Whitewater					
WoB. Whitewater-Orella					
WwB----------------------- Wortman	17	0.7	1.2	16	15
ZnD. Zigweid-Nihill					

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
AaA, AaB, AaC: Altvan	Silty	2,100	1,700	1,200
ArA: Arvada	Thin Claypan	930	780	540
BaA: Baca	Silty	2,100	1,800	1,200
BcB: Bankard	Sands	2,600	2,200	1,500
BfA: Beckton	Claypan	1,400	1,200	840
BhA*:				
Beckton	Claypan	1,400	1,200	840
Arvada	Thin Claypan	930	780	560
BkA, BkB, BlA, BlB: Blackpipe	Silty	2,300	1,900	1,400
BnC*:				
Blackpipe	Silty	2,300	1,900	1,400
Norrest	Clayey	1,900	1,600	1,100
BoA*, BoB*:				
Blackpipe	Silty	2,300	1,900	1,400
Wortman	Claypan	1,400	1,200	840
Bp: Bridgeport	Loamy Terrace	2,900	2,400	1,600
Ca: Cactusflat	Clayey	2,200	1,800	1,300
Cb*:				
Cactusflat	Clayey	2,200	1,800	1,300
Weta	Thin Claypan	1,200	1,000	200
CeA: Cedarpass	Silty	2,200	1,800	1,300
CfA*:				
Cedarpass	Silty	2,200	1,800	1,300
Denby	Clayey	2,300	1,900	1,300
Ch*:				
Cedarpass	Silty	2,200	1,800	1,300

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Ch*:				
Interior	Badland Overflow	1,800	1,500	100
Badland.				
ClF Colby	Thin Upland	1,700	1,400	1,000
CmC*:				
Colby	Thin Upland	1,700	1,400	1,000
Norka	Silty	2,300	2,000	1,400
Cn Colombo	Loamy Terrace	3,100	2,500	1,700
Co Colombo	Loamy Overflow	3,400	2,800	2,000
CuD*:				
Conata	Shallow Clay	1,600	1,400	960
Hisle	Thin Claypan	1,000	860	600
CyC Cushman	Silty	2,000	1,800	1,300
CzD*:				
Cushman	Silty	2,000	1,800	1,300
Shingle	Shallow	1,600	1,400	1,000
DmA Denby	Clayey	2,300	1,900	1,300
Eg Egas	Saline Lowland	2,800	2,300	1,600
EmA, EmB Emigrant	Silty	2,000	1,700	1,200
EnD*:				
Enning	Shallow	1,500	1,300	940
Minnequa	Thin Upland	1,800	1,500	1,100
FaE, FgE Fairburn	Thin Upland	1,600	1,300	900
FhE*:				
Fairburn	Thin Upland	1,600	1,300	900
Badland.				
FoF*:				
Fairburn	Thin Upland	1,600	1,300	900
Orella	Shallow Clay	1,000	700	500
Badland.				

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Gb: Glenberg	Loamy Overflow	2,900	2,400	1,700
GrE*:				
Grummit	Shallow Clay	1,700	1,400	980
Rock outcrop.				
Ha: Haverson	Loamy Terrace	2,600	2,100	1,500
Hc: Haverson	Loamy Overflow	2,900	2,400	1,700
HpB: Hisle	Thin Claypan	1,000	860	600
HrC*:				
Hisle	Thin Claypan	1,000	860	600
Rock outcrop.				
HsB*:				
Hisle	Thin Claypan	1,000	860	600
Slickspots				
Hv: Hoven	Closed Depression	2,600	2,200	1,500
In: Interior	Thin Upland	1,600	1,300	920
Io: Interior	Badland Overflow	1,800	1,500	100
IrB*:				
Interior	Badland Overflow	1,800	1,500	100
Cedarpass	Silty	2,200	1,800	1,300
Denby	Clayey	2,300	1,900	1,300
JaA, JaC: Jayem	Sandy	2,200	1,700	1,200
KtA, KyA, KyB, KyC: Kyle	Clayey	2,200	1,800	1,300
LaB, LaD: Larvie	Clayey	1,900	1,600	1,100
LhC*:				
Larvie	Clayey	1,900	1,600	1,100
Hisle	Thin Claypan	1,000	860	600
Lo: Lohmiller	Loamy Terrace	2,600	2,100	1,500

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Lp----------------------- Lohmiller	Loamy Overflow	2,900	2,400	1,700
MaB---------------------- Manvel	Thin Upland	1,900	1,600	1,100
MeC*:				
Manvel	Thin Upland	1,900	1,600	1,100
Minnequa	Thin Upland	1,800	1,500	1,100
MoE Midway	Shallow Clay	1,600	1,400	950
MosE Midway	Shallow Clay	1,500	1,200	780
MrC*:				
Minnequa	Thin Upland	1,800	1,500	1,100
Penrose	Shallow	1,400	1,200	900
NdE Nihill	Very Shallow	1,050	850	550
NeD Nihill	Very Shallow	940	790	550
NgA, NgB Norka	Silty	2,300	2,000	1,400
NhA*:				
Norka	Silty	2,300	2,000	1,400
Weta	Thin Claypan	1,200	1,000	700
NkD Norrest	Clayey	1,900	1,600	1,100
NuA Nunn	Silty	2,300	1,900	1,300
NuB, NuC Nunn	Silty	2,100	1,700	1,100
NvA*:				
Nunn	Silty	2,300	1,900	1,300
Beckton	Claypan	1,400	1,200	840
NvC*:				
Nunn	Silty	2,100	1,700	1,100
Beckton	Claypan	1,400	1,200	840
ObE*:				
Orella	Shallow Clay	1,000	700	500
Badland.				

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
OeE*:				
Orella	Shallow Clay	1,000	700	500
Interior	Badland Overflow	1,800	1,500	100
Badland.				
OtA, OtB Ottumwa	Clayey	2,400	2,000	1,400
OvC*:				
Ottumwa	Clayey	2,400	2,000	1,400
Razor	Clayey	1,900	1,600	1,100
Ow Owanka	Loamy Terrace	3,000	2,500	1,700
Ox*:				
Owanka	Loamy Terrace	3,000	2,000	1,700
Beckton	Claypan	1,400	1,200	840
PdF*:				
Penrose	Shallow	1,400	1,200	900
Rock outcrop.				
PeB, PeC, PeD Pierre	Clayey	1,900	1,600	1,100
PgD*:				
Pierre	Clayey	1,900	1,600	1,100
Grummit	Shallow Clay	1,700	1,400	980
PhB*:				
Pierre	Clayey	1,900	1,600	1,100
Hisle	Thin Claypan	1,000	860	600
RaB, RaC Razor	Clayey	1,900	1,600	1,100
RbD*:				
Razor	Clayey	1,900	1,600	1,100
Midway	Shallow Clay	1,700	1,400	980
SbF Samsil	Shallow Clay	1,700	1,400	980
ScE*:				
Samsil	Shallow Clay	1,700	1,400	980
Pierre	Clayey	1,900	1,600	1,100
SdF*:				
Samsil	Shallow Clay	1,700	1,400	980

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
SdF*:				
Rock outcrop.				
SeA, SeB, SeC: Satanta	Silty	2,400	2,000	1,400
SgA*:				
Satanta	Silty	2,400	2,000	1,400
Beckton	Claypan	1,400	1,200	840
SmA, SmB, SmC: Savo	Silty	2,300	1,900	1,300
StE*:				
Schamber	Very Shallow	480	810	570
Samsil	Shallow Clay	1,700	1,400	980
SuE: Shingle	Shallow	1,600	1,400	1,000
SvF*:				
Shingle	Shallow	1,600	1,400	1,000
Rock outcrop.				
SzB: Swanboy	Dense Clay	1,800	1,500	1,000
TfA: Tilford	Silty	2,400	2,000	1,400
VbD: Valent	Sands	2,200	1,900	1,300
VbwB*:				
Valent	Sands	2,200	1,900	1,300
Wortman	Claypan	1,400	1,200	840
WaA: Wanblee	Thin Claypan	910	760	530
WbB*:				
Wanblee	Thin Claypan	910	760	840
Wortman	Claypan	1,400	1,200	840
WeA: Weta	Thin Claypan	1,200	1,000	700
Wh: Whitelake	Sandy	2,500	2,100	1,500
WkA: Whitewater	Dense Clay	1,600	1,300	940

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
WoB*:				
Whitewater	Dense Clay	1,600	1,300	940
Orella	Shallow Clay	1,000	700	500
WwB Wortman	Claypan	1,400	1,200	840
ZnD*:				
Zigweid	Thin Upland	1,900	1,600	1,100
Nihill	Very Shallow	1,000	850	550

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AaA, AaB, AaC----- Altvan	Lilac, caragana, Peking cotoneaster.	Hackberry, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, honeylocust.	Siberian elm, ponderosa pine.	---	---
ArA--------------- Arvada	Rocky Mountain juniper, Siberian peashrub, skunkbush sumac, Tatarian honeysuckle.	Ponderosa pine, Russian-olive, Siberian elm.	---	---	---
BaA--------------- Baca	Lilac, American plum.	Russian-olive, Rocky Mountain juniper, Manchurian crabapple, chokecherry, caragana.	Honeylocust, green ash, hackberry, ponderosa pine.	Siberian elm------	---
Bb*. Badland					
BcB--------------- Bankard	Lilac, Siberian peashrub.	Ponderosa pine, eastern redcedar, Rocky Mountain juniper, green ash.	---	---	---
BfA--------------- Beckton	Eastern redcedar, Rocky Mountain juniper, caragana, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
BhA*:					
Beckton----------	Eastern redcedar, Rocky Mountain juniper, caragana, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Arvada.					
BkA, BkB, BlA, BlB-------------- Blackpipe	Lilac, caragana, Peking cotoneaster, skunkbush sumac.	Green ash, hackberry, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BnC*:					
Blackpipe-Norrest	Lilac, caragana, Peking cotoneaster, skunkbush sumac.	Green ash, hackberry, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---
BoA*, BoB*:					
Blackpipe--------	Lilac, caragana, Peking cotoneaster, skunkbush sumac.	Green ash, hackberry, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---
Wortman----------	Eastern redcedar, Rocky Mountain juniper, caragana, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Bp---------------- Bridgeport	Lilac, American plum.	Tatarian honeysuckle.	Eastern redcedar, blue spruce, ponderosa pine, hackberry, green ash, Russian-olive.	Honeylocust, Siberian elm.	Eastern cottonwood.
Ca---------------- Cactusflat	Lilac, American plum, caragana, Tatarian honeysuckle.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Cb*:					
Cactusflat-------	Lilac, American plum, caragana, Tatarian honeysuckle.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Weta.					
CeA--------------- Cedarpass	Caragana, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
CfA*:					
Cedarpass	Caragana, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm	---	---
Denby	Lilac, caragana, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Ch*:					
Cedarpass	Caragana, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm	---	---
Interior.					
Badland.					
ClF. Colby					
CmC*:					
Colby	Caragana, lilac, Peking cotoneaster, silver buffaloberry, skunkbush sumac.	Honeylocust, eastern redcedar, Russian-olive, ponderosa pine, Rocky Mountain juniper, green ash, black locust.	Siberian elm	---	---
Norka	American plum, lilac.	Manchurian crabapple, caragana, Rocky Mountain juniper, common chokecherry.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm	---
Cn, Co Colombo	Lilac, American plum.	Tatarian honeysuckle.	Green ash, hackberry, ponderosa pine, blue spruce, Russian-olive, eastern redcedar.	Siberian elm, honeylocust.	Cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Cp*:					
Colombo	Lilac, American plum.	Tatarian honeysuckle.	Green ash, hackberry, ponderosa pine, blue spruce, Russian-olive, eastern redcedar.	Siberian elm, honeylocust.	Cottonwood.
Urban land.					
CuD*:					
Conata.					
Hisle.					
CyC Cushman	Peking cotoneaster, caragana, lilac, skunkbush sumac.	Green ash, Russian-olive, Rocky Mountain juniper, eastern redcedar.	Ponderosa pine, Siberian elm, honeylocust.	---	---
CzD*:					
Cushman	Peking cotoneaster, caragana, lilac, skunkbush sumac.	Green ash, Russian-olive, Rocky Mountain juniper, eastern redcedar.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Shingle.					
DmA Denby	Lilac, caragana, American plum, Tatarian honeysuckle.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Eg. Egas					
EmA, EmB Emigrant	Lilac, caragana, Rocky Mountain juniper, Peking cotoneaster.	Green ash, Russian-olive, hackberry, eastern redcedar.	Siberian elm, honeylocust, ponderosa pine.	---	---
EnD* Enning-Minnequa					
FaE, FgE. Fairburn					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
FhE*:					
Fairburn.					
Badland.					
FoF*:					
Fairburn.					
Orella.					
Badland.					
Gb----------------Glenberg	Lilac, American plum.	Tatarian honeysuckle.	Green ash, hackberry, Russian-olive, eastern redcedar, blue spruce.	Eastern cottonwood, Siberian elm, honeylocust.	Cottonwood.
GrE*:					
Grummit.					
Rock outcrop.					
GsD*:					
Grummit.					
Urban land.					
Ha, Hc------------Haverson	Lilac, American plum.	Tatarian honeysuckle.	Honeylocust, ponderosa pine, green ash, hackberry, Russian-olive. blue spruce, eastern redcedar.	Siberian elm, honeylocust.	Cottonwood.
HpB. Hisle					
HrC*:					
Hisle.					
Rock outcrop.					
HsB*:					
Hisle.					
Slickspots.					
Hv. Hoven					
Hz. Hoven Variant					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
In, Io. Interior					
IrB*: Interior.					
Cedarpass	Caragana, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm	---	---
Denby	Lilac, caragana, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
JaA, JaC Jayem	Peking cotoneaster, Tatarian honeysuckle, lilac, American plum, caragana.	Rocky Mountain juniper, eastern redcedar, Russian-olive, common chokecherry, Manchurian crabapple.	Green ash, ponderosa pine, Siberian elm, honeylocust.	---	---
KtA, KyA, KyB, KyC Kyle	Caragana, American plum, lilac, Tatarian honeysuckle.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, eastern redcedar, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
LaB Larvie	American plum, lilac, Tatarian honeysuckle, caragana.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
LaD. Larvie					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
LhC*:					
Larvie	American plum, lilac, Tatarian honeysuckle.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Hisle.					
Lo Lohmiller	Lilac, caragana, American plum, Tatarian honeysuckle.	Russian-olive, eastern redcedar, Manchurian crabapple.	Ponderosa pine, green ash.	Siberian elm, honeylocust.	---
Lp Lohmiller	Lilac, caragana, American plum.	Manchurian crabapple, eastern redcedar, Russian-olive, Rocky Mountain juniper.	Green ash, ponderosa pine.	Siberian elm, honeylocust.	---
MaB Manvel	Peking cotoneaster, fragrant sumac, silver buffaloberry, caragana, lilac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, black locust, green ash, Russian-olive.	Honeylocust, Siberian elm.	---	---
MeC*:					
Manvel	Peking cotoneaster, fragrant sumac, silver buffaloberry, caragana, lilac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, black locust, green ash, Russian-olive.	Honeylocust, Siberian elm.	---	---
Minnequa	Peking cotoneaster, fragrant sumac, silver buffaloberry, caragana, lilac.	Ponderosa pine, green ash, Russian-olive, Rocky Mountain juniper, eastern redcedar.	Siberian elm, honeylocust.	---	---
MgC*:					
Manvel	Siberian peashrub, fragrant sumac, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, black locust, green ash, Russian-olive.	Honeylocust, Siberian elm.	---	---
Urban land.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MoE, MosE. Midway					
MpD*: Midway.					
Urban land.					
MrC*: Minnequa	Peking cotoneaster, fragrant sumac, silver buffaloberry, caragana, lilac.	Ponderosa pine, green ash, Russian-olive, Rocky Mountain juniper, eastern redcedar.	Siberian elm, honeylocust.	---	---
Penrose.					
NdE, NeD. Nihill					
NgA, NgB Norka	American plum, lilac.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, caragana.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm	---
NhA*: Norka	American plum, lilac.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, caragana.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm	---
Weta.					
NkD Norrest	Lilac, caragana, Peking cotoneaster, skunkbush sumac.	Green ash, hackberry, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---
NuA, NuB, NuC Nunn	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, plum, caragana.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm	---
NvA*, NvC*: Nunn	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, caragana.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
NvA*, NvC*:					
Beckton	Eastern redcedar, Rocky Mountain juniper, silver buffaloberry, lilac, Tatarian honeysuckle, caragana.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
NwA*:					
Nunn	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, plum, caragana.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm	---
Urban land.					
ObE*:					
Orella.					
Badland.					
OeE*:					
Orella.					
Interior.					
Badland.					
OtA, OtB Ottumwa	Caragana, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
OvC*:					
Ottumwa	Caragana, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Razor	Tatarian honeysuckle, lilac, caragana, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Ow----------------- Owanka	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, caragana.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm------	---
Ox*:					
Owanka-----------	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, caragana.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm------	---
Beckton----------	Caragana, eastern redcedar, Rocky Mountain juniper, silver buffaloberry, lilac, Tatarian honeysuckle.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
PdF*:					
Penrose.					
Rock outcrop.					
PeB, PeC, PeD----- Pierre	Caragana, American plum, lilac, Tatarian honeysuckle.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
PgD*:					
Pierre-----------	Caragana, American plum, lilac, Tatarian honeysuckle.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Grummit.					
PhB*:					
Pierre-----------	Caragana, American plum, lilac, Tatarian honeysuckle.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Hisle.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
PkC*:					
Pierre-----------	Siberian peashrub, golden currant, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, common chokecherry, eastern redcedar.	Siberian elm------	---	---
Urban land.					
Ps*. Pits					
RaB, RaC---------- Razor	Tatarian honeysuckle, lilac, caragana, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
RbD*:					
Razor------------	Tatarian honeysuckle, lilac, caragana, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Midway.					
Rv*. Riverwash					
SbF. Samsil					
ScE*:					
Samsil.					
Pierre.					
SdF*:					
Samsil.					
Rock outcrop.					
SeA, SeB, SeC----- Satanta	Lilac, caragana, American plum.	Russian-olive, common chokecherry, Rocky Mountain juniper, Manchurian crabapple.	Eastern redcedar, honeylocust, ponderosa pine, green ash, hackberry, bur oak.	Siberian elm------	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
SgA*:					
Satanta----------	Caragana, American plum, lilac, Amur honeysuckle.	Russian-olive, common chokecherry, Manchurian crabapple.	Eastern redcedar, honeylocust, ponderosa pine, green ash, hackberry.	Siberian elm------	---
Beckton----------	Caragana, eastern redcedar, Rocky Mountain juniper, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
SkA*, SkB*:					
Satanta----------	Fragrant sumac, lilac, Amur honeysuckle.	Russian-olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, hackberry, bur oak.	Siberian elm------	---
Urban land.					
SmA, SmB, SmC----- Savo	American plum, lilac.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, caragana.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm------	---
SoB*:					
Savo-------------	American plum, lilac.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm------	---
Urban land.					
StE*:					
Schamber.					
Samsil.					
SuE. Shingle					
SvF*:					
Shingle.					
Rock outcrop.					
SzB. Swanboy					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
TfA: Tilford	Lilac, American plum.	Manchurian crabapple, Russian-olive, Rocky Mountain juniper, chokecherry, caragana.	Honeylocust, green ash, hackberry, ponderosa pine.	Siberian elm	---
VbD. Valent					
VbwB*: Valent.					
Wortman	Rocky Mountain juniper, eastern redcedar, silver buffaloberry, lilac, Tatarian honeysuckle, caragana.	Siberian elm, ponderosa pine, green ash, Russian-olive.	---	---	---
WaA. Wanblee					
WbB*: Wanblee.					
Wortman	Eastern redcedar, Rocky Mountain juniper, silver buffaloberry, lilac, Tatarian honeysuckle, caragana.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
WeA. Weta					
Wh: Whitelake	American plum, lilac, Tatarian honeysuckle.	Green ash, Manchurian crabapple, Rocky Mountain juniper, common chokecherry, caragana.	Honeylocust, Siberian elm, ponderosa pine, Russian-olive.	---	---
WkA. Whitewater					
WoB*: Whitewater.					
Orella.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
WwB---------------Wortman	Eastern redcedar, Rocky Mountain juniper, caragana, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
ZnD*:					
Zigweid----------	Lilac, caragana, American plum.	Rocky Mountain juniper, Manchurian crabapple, chokecherry.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm------	---
Nihill.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
AaA: Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AaB: Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
AaC: Altvan	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
ArA: Arvada	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
BaA: Baca	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Bb*. Badland				
BcB: Bankard	Severe: flooding.	Slight	Moderate: slope.	Slight.
BfA: Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
BhA*:				
Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Arvada	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
BkA: Blackpipe	Slight	Slight	Slight	Slight.
BkB: Blackpipe	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
BlA: Blackpipe	Slight	Slight	Slight	Slight.
BlB: Blackpipe	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
BnC*:				
Blackpipe	Slight	Slight	Severe: slope.	Slight.
Norrest	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BoA*:				
Blackpipe	Slight	Slight	Slight	Slight.
Wortman	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
BoB*:				
Blackpipe	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
Wortman	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Bp Bridgeport	Severe: flooding.	Slight	Slight	Slight.
Ca Cactusflat	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Cb*:				
Cactusflat	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Weta	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
CeA Cedarpass	Slight	Slight	Slight	Slight.
CfA*:				
Cedarpass	Slight	Slight	Slight	Slight.
Denby	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Ch*:				
Cedarpass	Slight	Slight	Moderate: slope.	Slight.
Interior	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Badland.				
ClF. Colby				
CmC*:				
Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Norka	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Cn Colombo	Severe: flooding.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Co: Colombo	Severe: flooding.	Moderate: dusty.	Moderate: small stones, flooding.	Moderate: dusty.
Cp*:				
Colombo	Severe: flooding.	Moderate: dusty.	Moderate: slope, small stones.	Moderate: dusty.
Urban land.				
CuD*:				
Conata	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: slope, excess sodium.	Moderate: dusty.
CyC: Cushman	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
CzD*:				
Cushman	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Shingle	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: dusty.
DmA: Denby	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Eg: Egas	Severe: wetness, flooding.	Severe: wetness, excess salt.	Severe: wetness.	Severe: wetness.
EmA: Emigrant	Moderate: dusty.	Moderate: dusty.	Slight	Moderate: dusty.
EmB: Emigrant	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.
EnD*:				
Enning	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.
Minnequa	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Slight.
FaE: Fairburn	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
FgE: Fairburn	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope.
FhE*:				
Fairburn	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.
Badland.				
FoF*:				
Fairburn	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
Orella	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
Badland.				
Gb: Glenberg	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight.
GrE*:				
Grummit	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Moderate: too clayey, slope.
Rock outcrop.				
GsD*:				
Grummit	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Moderate: too clayey, slope.
Urban land.				
Ha: Haverson	Severe: flooding.	Moderate: dusty.	Slight	Moderate: dusty.
Hc: Haverson	Severe: flooding.	Moderate: dusty.	Moderate: slope.	Moderate: dusty.
HpB: Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
HrC*:				
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Rock outcrop.				

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
HsB*:				
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Slickspots.				
Hv: Hoven	Severe: ponding, percs slowly, excess sodium.	Severe: ponding, excess sodium, percs slowly.	Severe: ponding, percs slowly, excess sodium.	Severe: ponding.
Hz: Hoven Variant	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.
In: Interior	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Io: Interior	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
IrB*:				
Interior	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Cedarpass	Slight	Slight	Moderate: slope.	Slight.
Denby	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
JaA: Jayem	Slight	Slight	Moderate: small stones.	Slight.
JaC: Jayem	Slight	Slight	Moderate: slope, small stones.	Slight.
KtA, KyA: Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Severe: erodes easily.
KyB: Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Severe: erodes easily.
KyC: Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
LaB: Larvie	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.
LaD: Larvie	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
LhC*:				
Larvie	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Lo: Lohmiller	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Lp: Lohmiller	Severe: flooding.	Moderate: too clayey.	Moderate: flooding.	Moderate: too clayey.
MaB: Manvel	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
MeC*:				
Manvel	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
Minnequa	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Slight.
MgC*:				
Manvel	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Urban land.				
MoE: Midway	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
MosE: Midway	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
MpD*:				
Midway	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Urban land.				
MrC*:				
Minnequa	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Slight.
Penrose	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: dusty.
NdE: Nihill	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
NeD: Nihill	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.
NgA: Norka	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
NgB: Norka	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
NhA*:				
Norka	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Weta	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
NkD: Norrest	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
NuA: Nunn	Slight	Slight	Moderate: small stones.	Moderate: dusty.
NuB: Nunn	Slight	Slight	Moderate: slope.	Moderate: dusty.
NuC: Nunn	Slight	Slight	Severe: slope.	Moderate: dusty.
NvA*:				
Nunn	Slight	Slight	Moderate: small stones.	Moderate: dusty.
Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
NvC*:				
Nunn	Slight	Slight	Severe: slope.	Moderate: dusty.
Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
NwA*:				
Nunn	Slight	Slight	Moderate: small stones.	Moderate: dusty.
Urban land.				
ObE*:				
Orella	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
Badland.				
OeE*:				
Orella	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
OeE*:				
Interior	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Badland.				
OtA Ottumwa	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Severe: erodes easily.
OtB Ottumwa	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Severe: erodes easily.
OvC*:				
Ottumwa	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Severe: erodes easily.
Razor	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Ow Owanka	Slight	Slight	Slight	Slight.
Ox*:				
Owanka	Slight	Slight	Slight	Slight.
Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
PdF*:				
Penrose	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
Rock outcrop.				
PeB Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Severe: erodes easily.
PeC Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
PeD Pierre	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
PgD*:				
Pierre	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
Grummit	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Moderate: too clayey.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PhB*:				
Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Severe: erodes easily.
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
PkC*:				
Pierre	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
Urban land.				
Ps*. Pits				
RaB Razor	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
RaC Razor	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
RbD*:				
Razor	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Rv*. Riverwash				
SbF Samsil	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
ScE*:				
Samsil	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
Pierre	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
SdF*:				
Samsil	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
Rock outcrop.				

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SeA: Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
SeB: Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
SeC: Satanta	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
SgA*:				
Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
SkA*:				
Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Urban land.				
SkB*:				
Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Urban land.				
SmA: Savo	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
SmB: Savo	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
SmC: Savo	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
SoB*:				
Savo	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Urban land.				
StE*:				
Schamber	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Samsil	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
SuE: Shingle	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope, dusty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SvF*:				
Shingle	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop.				
SzB: Swanboy	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Severe: erodes easily.
TfA: Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
VbD: Valent	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
VbwB*:				
Valent	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Wortman	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
WaA: Wanblee	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
WbB*:				
Wanblee	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Wortman	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
WeA: Weta	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Wh: Whitelake	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
WkA: Whitewater	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.
WoB*:				
Whitewater	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
Orella	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
WwB: Wortman	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
ZnD*:				
Zigweid	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Nihill	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
AaA---------------- Altvan	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
AaB---------------- Altvan	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
AaC---------------- Altvan	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ArA---------------- Arvada	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BaA---------------- Baca	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Bb*. Badland									
BcB---------------- Bankard	Poor	Fair	Fair	Good	---	---	---	---	---
BfA---------------- Beckton	Poor	Poor	Poor	Poor	Good	Very poor.	Very poor.	Very poor.	Very poor.
BhA*:									
Beckton-----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Arvada------------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BkA, BkB, BlA, BlB- Blackpipe	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BnC*:									
Blackpipe---------	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Norrest-----------	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BoA*, BoB*:									
Blackpipe---------	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Wortman-----------	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.
Bp----------------- Bridgeport	Fair	Good	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.
Ca----------------- Cactusflat	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
Cb*:									
Cactusflat	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Weta	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CeA Cedarpass	Poor	Good	Good	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
CfA*:									
Cedarpass	Poor	Good	Good	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Denby	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Ch*:									
Cedarpass	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Interior	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Badland.									
ClF Colby	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
CmC*:									
Colby	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Norka	Very poor.	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Cn Colombo	Fair	Good	Good	Good	Fair	Very poor.	Poor	Very poor.	Very poor.
Co Colombo	Poor	Very poor.	Good	Good	Good	Very poor.	Fair	Very poor.	Very poor.
Cp*:									
Colombo.									
Urban land.									
CuD*:									
Conata	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hisle	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CyC Cushman	Poor	Good	Good	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.
CzD*:									
Cushman	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
CzD*:									
Shingle	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
DmA: Denby	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Eg: Egas	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Fair.
EmA, EmB: Emigrant	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
EnD*:									
Enning	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Minnequa	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
FaE, FgE: Fairburn	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
FhE*:									
Fairburn	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Badland.									
FoF*:									
Fairburn	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Orella	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Badland.									
Gb: Glenberg	Fair	Fair	Good	Good	Good	Very poor.	Poor	Very poor.	Very poor.
GrE*:									
Grummit	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Rock outcrop.									
GsD*:									
Grummit.									
Urban land.									
Ha: Haverson	Fair	Good	Good	Good	Fair	Very poor.	Poor	Very poor.	Very poor.
Hc: Haverson	Poor	Very poor.	Good	Good	Good	Very poor.	Fair	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
	Potential for habitat elements								
HpB: Hisle	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
HrC*:									
Hisle	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
HsB*:									
Hisle	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Slickspots.									
Hv: Hoven	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Fair.
Hz: Hoven Variant	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor	Fair	Fair.
In: Interior	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Io: Interior	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
IrB*:									
Interior	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Cedarpass	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Denby	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
JaA: Jayem	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.
JaC: Jayem	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.
KtA, KyB: Kyle	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
KyC: Kyle	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
LaB: Larvie	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
LaD: Larvie	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
LhC*:									
Larvie	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
LhC*:									
Hisle	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Lo: Lohmiller	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.
Lp: Lohmiller	Poor	Very poor.	Good	Fair	Fair	Very poor.	Poor	Very poor.	Very poor.
MaB: Manvel	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
MeC*:									
Manvel	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Minnequa	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
MgC*:									
Manvel.									
Urban land.									
MoE: Midway	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
MosE: Midway	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
MpD*:									
Midway.									
Urban land.									
MrC*:									
Minnequa	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Penrose	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
NdE: Nihill	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
NeD: Nihill	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
NgA, NgB: Norka	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NhA*:									
Norka	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Weta	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
NkD: Norrest	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NuA, NuB: Nunn	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NuC: Nunn	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NvA*:									
Nunn	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Beckton	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NvC*:									
Nunn	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Beckton	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NwA*:									
Nunn.									
Urban land.									
ObE*:									
Orella	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Badland.									
OeE*:									
Orella	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Interior	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Badland.									
OtA, OtB: Ottumwa	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
OvC*:									
Ottumwa	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Razor	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Ow: Owanka	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Ox*: Owanka	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
PdF*:									
Penrose	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Rock outcrop.									
PeB, PeC Pierre	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PeD Pierre	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PgD*:									
Pierre	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Grummit	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.
PhB*:									
Pierre	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hisle	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.
PkC*:									
Pierre.									
Urban land.									
Ps*. Pits									
RaB, RaC Razor	Poor	Fair	Good	Fair	Very poor.	Very poor.	---	Very poor.	Very poor.
RbD*:									
Razor	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	---	Very poor.	Very poor.
Midway	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Rv*. Riverwash									
SbF Samsil	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.
ScE*:									
Samsil	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.
Pierre	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SdF*:									
Samsil	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
SdF*:									
Rock outcrop.									
SeA, SeB----------- Satanta	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SeC---------------- Satanta	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SgA*:									
Satanta-----------	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Beckton-----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SkA*, SkB*:									
Satanta.									
Urban land.									
SmA, SmB----------- Savo	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SmC---------------- Savo	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SoB*:									
Savo.									
Urban land.									
StE*:									
Schamber----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.
Samsil------------	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.
SuE---------------- Shingle	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
SvF*:									
Shingle-----------	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Rock outcrop.									
SzB---------------- Swanboy	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
TfA---------------- Tilford	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
VbD---------------- Valent	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
VbwB*:									
Valent------------	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Fair	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herba-ceous plants	Planted trees and shrubs	Native decid-uous trees	Native conif-erous plants	Native shrubs	Wetland plants	Shallow water areas
VbwB*:									
Wortman	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
WaA: Wanblee	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
WbB*:									
Wanblee	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Wortman	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
WeA: Weta	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Wh: Whitelake	Poor	Fair	Good	Fair	Very poor.	Very poor.	---	Very poor.	Very poor.
WkA: Whitewater	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
WoB*:									
Whitewater	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Orella	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
WwB: Wortman	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ZnD*:									
Zigweid	Very poor.	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Nihill	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AaA: Altvan	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
AaB: Altvan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
AaC: Altvan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
ArA: Arvada	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
BaA: Baca	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
Bb*. Badland					
BcB: Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
BfA: Beckton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
BhA*:					
Beckton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Arvada	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
BkA: Blackpipe	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
BkB: Blackpipe	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
BlA: Blackpipe	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
BlB: Blackpipe	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
BnC*:					
Blackpipe	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
BnC*:					
Norrest	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
BoA*:					
Blackpipe	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Wortman	Slight	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
BoB*:					
Blackpipe	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Wortman	Slight	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Bp Bridgeport	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Ca Cactusflat	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Cb*:					
Cactusflat	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Weta	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
CeA Cedarpass	Slight	Slight	Slight	Slight	Severe: low strength.
CfA*:					
Cedarpass	Slight	Slight	Slight	Slight	Severe: low strength.
Denby	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Ch*:					
Cedarpass	Slight	Slight	Slight	Slight	Severe: low strength.
Interior	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Badland.					
ClF Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
CmC*:					
Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Norka	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Cn Colombo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Co Colombo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Cp*:					
Colombo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Urban land.					
CuD*:					
Conata	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Hisle	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
CyC Cushman	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
CzD*:					
Cushman	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.
Shingle	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.
DmA Denby	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Eg Egas	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
EmA, EmB Emigrant	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
EnD*:					
Enning	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Minnequa	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
FaE, FgE Fairburn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
FhE*:					
Fairburn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Badland.					
FoF*:					
Fairburn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Orella	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Badland.					
Gb Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
GrE*:					
Grummit	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Rock outcrop.					
GsD*:					
Grummit	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Urban land.					
Ha Haverson	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Hc Haverson	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
HpB Hisle	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
HrC*:					
Hisle	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Rock outcrop.					
HsB*:					
Hisle	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Slickspots.					
Hv Hoven	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: ponding, low strength, shrink-swell.
Hz Hoven Variant	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell, low strength.
In Interior	Moderate: too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Io Interior	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
IrB*:					
Interior	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Cedarpass	Slight	Slight	Slight	Slight	Severe: low strength.
Denby	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
JaA Jayem	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
JaC Jayem	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
KtA, KyA, KyB, KyC Kyle	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
LaB Larvie	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
LaD Larvie	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
LhC*:					
Larvie	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Hisle	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Lo Lohmiller	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.
Lp Lohmiller	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.
MaB Manvel	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
MeC*:					
Manvel	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Minnequa	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
MgC*:					
Manvel	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Urban land.					
MoE, MosE Midway	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
MpD*:					
Midway	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Urban land.					
MrC*:					
Minnequa	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Penrose	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
NdE, NeD---------- Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
NgA--------------- Norka	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: frost action.
NgB--------------- Norka	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: frost action.
NhA*:					
Norka------------	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: frost action.
Weta-------------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
NkD--------------- Norrest	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
NuA, NuB, NuC----- Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
NvA*, NvC*:					
Nunn-------------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Beckton----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
NwA*:					
Nunn-------------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Urban land.					
ObE*:					
Orella-----------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Badland.					
OeE*:					
Orella-----------	Moderate: slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Interior---------	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Badland.					

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
OtA, OtB---------- Ottumwa	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
OvC*:					
Ottumwa----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Razor------------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Ow---------------- Owanka	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Ox*:					
Owanka-----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Beckton----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
PdF*:					
Penrose----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
PeB, PeC---------- Pierre	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
PeD--------------- Pierre	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
PgD*:					
Pierre-----------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Grummit----------	Moderate: slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
PhB*:					
Pierre-----------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hisle------------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
PkC*:					
Pierre	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Urban land.					
Ps*. Pits					
RaB, RaC Razor	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
RbD*:					
Razor	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope.
Rv*. Riverwash					
SbF Samsil	Severe: slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
ScE*:					
Samsil	Severe: slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Pierre	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
SdF*:					
Samsil	Severe: slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Rock outcrop.					
SeA Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.
SeB, SeC Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
SgA*:					
Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
SgA*:					
Beckton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
SkA*:					
Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.
Urban land.					
SkB*:					
Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Urban land.					
SmA, SmB, SmC Savo	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
SoB*:					
Savo	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Urban land.					
StE*:					
Schamber	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Samsil	Severe: slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
SuE Shingle	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
SvF*:					
Shingle	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.
Rock outcrop.					
SzB Swanboy	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
TfA Tilford	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
VbD Valent	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
VbwB*:					
Valent	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Wortman	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
WaA: Wanblee	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
WbB*:					
Wanblee	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Wortman	Slight	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
WeA: Weta	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Wh: Whitelake	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.
WkA: Whitewater	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
WoB*:					
Whitewater	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Orella	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
WwB: Wortman	Slight	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
ZnD*:					
Zigweid	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AaA, AaB: Altvan	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
AaC: Altvan	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy.
ArA: Arvada	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
BaA: Baca	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Bb*: Badland					
BcB: Bankard	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
BfA: Beckton	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
BhA*:					
Beckton	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Arvada	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
BkA, BkB, BlA, BlB: Blackpipe	Severe: seepage, thin layer.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.
BnC*:					
Blackpipe	Severe: seepage, thin layer.	Severe: seepage, slope.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.
Norrest	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, hard to pack.
BoA*, BoB*:					
Blackpipe	Severe: seepage, thin layer.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BoA*, BoB*:					
Wortman	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, excess sodium.	Slight	Poor: area reclaim, excess sodium, thin layer.
Bp: Bridgeport	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Ca: Cactusflat	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey.
Cb*:					
Cactusflat	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey.
Weta	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
CeA: Cedarpass	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: thin layer.
CfA*:					
Cedarpass	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: thin layer.
Denby	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Ch*:					
Cedarpass	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: thin layer.
Interior	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Badland.					
ClF: Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CmC*:					
Colby	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Norka	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Cn: Colombo	Moderate: flooding, percs slowly.	Moderate: seepage.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
Co: Colombo	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Cp*:					
Colombo	Moderate: flooding, percs slowly.	Moderate: seepage, slope.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
Urban land.					
CuD*:					
Conata	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Hisle	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, hard to pack, thin layer.
CyC Cushman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: depth to rock.
CzD*:					
Cushman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
Shingle	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: depth to rock.
DmA Denby	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Eg Egas	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: too clayey, wetness, flooding.	Severe: flooding, wetness.	Poor: too clayey, wetness, hard to pack.
EmA, EmB Emigrant	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
EnD*:					
Enning	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Minnequa	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: depth to rock.
FaE, FgE Fairburn	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FhE*:					
Fairburn----------	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Badland.					
FoF*:					
Fairburn----------	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Orella-------------	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Badland.					
Gb----------------- Glenberg	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
GrE*:					
Grummit-----------	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
GsD*:					
Grummit-----------	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Urban land.					
Ha----------------- Haverson	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Hc. Haverson					
HpB---------------- Hisle	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage.	Slight-----------	Poor: area reclaim, hard to pack, thin layer.
HrC*:					
Hisle--------------	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage.	Slight-----------	Poor: area reclaim, hard to pack, thin layer.
Rock outcrop.					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HsB*:					
Hisle	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, hard to pack, thin layer.
Slickspots.					
Hv: Hoven	Severe: percs slowly, ponding.	Slight	Severe: too clayey, ponding, excess sodium.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Hz: Hoven Variant	Severe: ponding, percs slowly.	Moderate: seepage.	Severe: seepage, ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
In: Interior	Severe: percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Io: Interior	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
IrB*:					
Interior	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Cedarpass	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: thin layer.
Denby	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
JaA, JaC: Jayem	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
KtA, KyA: Kyle	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
KyB: Kyle	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
KyC: Kyle	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LaB: Larvie	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, hard to pack, thin layer.
LaD: Larvie	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: seepage, slope.	Poor: area reclaim, hard to pack, thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LhC*:					
Larvie	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: seepage, slope.	Poor: area reclaim, hard to pack, thin layer.
Hisle	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, hard to pack, thin layer.
Lo: Lohmiller	Severe: percs slowly.	Slight	Moderate: flooding.	Moderate: flooding.	Poor: hard to pack.
Lp: Lohmiller	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack.
MaB: Manvel	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
MeC*:					
Manvel	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Minnequa	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: depth to rock.
MgC*:					
Manvel	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Urban land.					
MoE: Midway	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
MosE: Midway	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
MpD*:					
Midway	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Urban land.					
MrC*:					
Minnequa	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: depth to rock.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MrC*:					
Penrose	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
NdE, NeD: Nihill	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
NgA: Norka	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
NgB: Norka	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
NhA*:					
Norka	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Weta	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
NkD: Norrest	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
NuA: Nunn	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NuB: Nunn	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NuC: Nunn	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NvA*:					
Nunn	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Beckton	Severe: percs slowly.	Slight	Slight	Slight	Good.
NvC*:					
Nunn	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Beckton	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
NwA*:					
Nunn	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey. hard to pack.
Urban land.					
ObE*:					
Orella	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Badland.					
OeE*:					
Orella	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, hard to pack.
Interior	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Badland.					
OtA Ottumwa	Severe: percs slowly.	Moderate: seepage.	Severe: seepage, too clayey.	Slight	Poor: too clayey, hard to pack.
OtB Ottumwa	Severe: percs slowly.	Severe: slope.	Severe: seepage, too clayey.	Slight	Poor: too clayey, hard to pack.
OvC*:					
Ottumwa	Severe: percs slowly.	Severe: slope.	Severe: seepage, too clayey.	Slight	Poor: too clayey, hard to pack.
Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: depth to rock, hard to pack.
Ow Owanka	Severe: percs slowly.	Slight	Slight	Slight	Poor: hard to pack.
Ox*:					
Owanka	Severe: percs slowly,	Slight	Slight	Slight	Poor: hard to pack.
Beckton	Severe: percs slowly.	Slight	Slight	Slight	Good.
PdF*:					
Penrose	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PeB: Pierre	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
PeC: Pierre	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
PeD: Pierre	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, slope, too clayey.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
PgD*:					
Pierre	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Severe: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
Grummit	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, hard to pack.
PhB*:					
Pierre	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
Hisle	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, hard to pack, thin layer.
PkC*:					
Pierre	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
Urban land.					
Ps*. Pits					
RaB: Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: depth to rock, hard to pack.
RaC: Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: depth to rock, hard to pack.
RbD*:					
Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RbD*:					
Midway	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Rv*. Riverwash					
SbF Samsil	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
ScE*:					
Samsil	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Pierre	Severe: thin layer, percs slowly, seepage.	Severe: seepage, slope.	Severe: seepage, slope, too clayey.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
SdF*:					
Samsil	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
SeA Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
SeB Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SeC Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SgA*:					
Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Beckton	Severe: percs slowly.	Slight	Slight	Slight	Good.
SkA*:					
Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
SkB*:					
Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SmA: Savo	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
SmB: Savo	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SmC: Savo	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SoB*:					
Savo	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
StE*:					
Schamber	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, small stones.
Samsil	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
SuE: Shingle	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
SvF*:					
Shingle	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Rock outcrop.					
SzB: Swanboy	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
TfA: Tilford	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
VbD: Valent	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
VbwB*:					
Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
Wortman	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey, excess sodium.	Slight	Poor: area reclaim, too clayey, hard to pack.
WaA: Wanblee	Severe: percs slowly, thin layer, seepage.	Severe: seepage.	Severe: seepage, excess sodium.	Slight	Poor: area reclaim, excess sodium, thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
WbB*:					
Wanblee	Severe: percs slowly, thin layer, seepage.	Severe: seepage.	Severe: seepage, excess sodium.	Slight	Poor: area reclaim, excess sodium, thin layer.
Wortman	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, excess sodium.	Slight	Poor: area reclaim, excess sodium, thin layer.
WeA Weta	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey, excess sodium.	Slight	Poor: too clayey, hard to pack, excess sodium.
Wh Whitelake	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, excess sodium.	Severe: seepage.	Poor: too sandy, excess sodium.
WkA Whitewater	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Slight	Poor: area reclaim, too clayey, hard to pack.
WoB*:					
Whitewater	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Slight	Poor: area reclaim, too clayey, hard to pack.
Orella	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, hard to pack.
WwB Wortman	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, excess sodium.	Slight	Poor: area reclaim, excess sodium, thin layer.
ZnD*:					
Zigweid	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Nihill	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaA, AaB, AaC: Altvan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
ArA: Arvada	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess sodium.
BaA: Baca	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Bb*. Badland				
BcB: Bankard	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
BfA: Beckton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium.
BhA*:				
Beckton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium.
Arvada	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess sodium.
BkA, BkB, BlA, BlB: Blackpipe	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BnC*:				
Blackpipe	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Norrest	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BoA*, BoB*:				
Blackpipe	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Wortman	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Bp: Bridgeport	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ca: Cactusflat	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Cb*:				
Cactusflat	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Weta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
CeA: Cedarpass	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CfA*:				
Cedarpass	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Denby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ch*:				
Cedarpass	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Interior	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Badland.				
ClF: Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CmC*:				
Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Norka	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Cn, Co: Colombo	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
Cp*:				
Colombo	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
Urban land.				
CuD*:				
Conata	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CuD*:				
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, too clayey, excess salt.
CyC Cushman	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, small stones.
CzD*:				
Cushman	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, small stones.
Shingle	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
DmA Denby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Eg Egas	Poor: shrink-swell, wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
EmA, EmB Emigrant	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
EnD*:				
Enning	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim, slope.
Minnequa	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey.
FaE Fairburn	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim, slope.
FgE Fairburn	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim, slope.
FhE*:				
Fairburn	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim, slope.
Badland.				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FoF*:				
Fairburn	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim, slope.
Orella	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Badland.				
Gb: Glenberg	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
GrE*:				
Grummit	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Rock outcrop.				
GsD*:				
Grummit	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Urban land.				
Ha, Hc: Haverson	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
HpB: Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, too clayey, excess salt.
HrC*:				
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, too clayey, excess salt.
Rock outcrop.				
HsB*:				
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, too clayey, excess salt.
Slickspots.				
Hv: Hoven	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hz------------------- Hoven Variant	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
In------------------- Interior	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Io------------------- Interior	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
IrB*:				
Interior-------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cedarpass------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Denby----------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
JaA, JaC------------- Jayem	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
KtA, KyA, KyB, KyC---- Kyle	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LaB, LaD------------- Larvie	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LhC*:				
Larvie---------------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hisle----------------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, too clayey, excess salt.
Lo------------------- Lohmiller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Lp------------------- Lohmiller	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MaB------------------ Manvel	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MeC*:				
Manvel---------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MeC*:				
Minnequa	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey.
MgC*:				
Manvel	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Urban land.				
MoE Midway	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
MosE Midway	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
MpD*:				
Midway	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Urban land.				
MrC*:				
Minnequa	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey.
Penrose	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
NdE Nihill	Poor: slope.	Improbable: small stones.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
NeD Nihill	Fair: slope.	Improbable: small stones.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
NgA, NgB Norka	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
NhA*:				
Norka	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Weta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
NkD: Norrest	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
NuA, NuB, NuC: Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
NvA*, NvC*:				
Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Beckton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium.
NwA*:				
Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
ObE*:				
Orella	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Badland.				
OeE*:				
Orella	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Interior	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Badland.				
OtA, OtB: Ottumwa	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
OvC*:				
Ottumwa	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Razor	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ow: Owanka	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ox*:				
Owanka	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Beckton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium.
PdF*:				
Penrose	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Rock outcrop.				
PeB, PeC Pierre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
PeD Pierre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
PgD*:				
Pierre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Grummit	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
PhB*:				
Pierre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, too clayey, excess salt.
PkC*:				
Pierre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
Ps*. Pits				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RaB, RaC: Razor	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
RbD*:				
Razor	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Midway	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
Rv*. Riverwash				
SbF: Samsil	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
ScE*:				
Samsil	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Pierre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
SdF*:				
Samsil	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Rock outcrop.				
SeA, SeB, SeC: Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
SgA*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Beckton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium.
SkA*, SkB*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
SmA, SmB, SmC: Savo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SoB*:				
Savo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
StE*:				
Schamber	Poor: slope.	Probable	Probable	Poor: slope, small stones, area reclaim.
Samsil	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
SuE: Shingle	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
SvF*:				
Shingle	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Rock outcrop.				
SzB: Swanboy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
TfA: Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
VbD: Valent	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
VbwB*:				
Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Wortman	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
WaA: Wanblee	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess salt, excess sodium.
WbB*:				
Wanblee	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess salt, excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
WbB*:				
Wortman	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
WeA: Weta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Wh: Whitelake	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
WkA: Whitewater	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WoB*:				
Whitewater	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Orella	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
WwB: Wortman	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
ZnD*:				
Zigweid	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Nihill	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
AaA: Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Too arid.
AaB: Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Too arid.
AaC: Altvan	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope	Slope, too sandy.	Too arid, slope.
ArA: Arvada	Slight	Severe: excess sodium.	Deep to water	Droughty	Percs slowly	Too arid, excess sodium.
BaA: Baca	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Too arid, erodes easily.
Bb*. Badland						
BcB: Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
BfA: Beckton	Slight	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Too arid, excess salt, excess sodium.
BhA*:						
Beckton	Slight	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Too arid, excess salt, excess sodium.
Arvada	Slight	Severe: excess sodium.	Deep to water	Droughty	Percs slowly	Too arid, excess sodium.
BkA: Blackpipe	Moderate: seepage.	Severe: thin layer.	Deep to water	Thin layer	Area reclaim	Area reclaim.
BkB: Blackpipe	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Area reclaim	Area reclaim.
BlA: Blackpipe	Moderate: seepage.	Severe: thin layer.	Deep to water	Thin layer	Area reclaim	Area reclaim.
BlB: Blackpipe	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Area reclaim	Area reclaim.
BnC*:						
Blackpipe	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Area reclaim	Area reclaim.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
BnC*:						
Norrest	Severe: slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
BoA*:						
Blackpipe	Moderate: seepage.	Severe: thin layer.	Deep to water	Thin layer	Area reclaim	Area reclaim.
Wortman	Moderate: seepage.	Severe: piping, excess sodium.	Deep to water	Percs slowly, thin layer.	Area reclaim	Excess sodium, area reclaim, percs slowly.
BoB*:						
Blackpipe	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Area reclaim	Area reclaim.
Wortman	Moderate: seepage.	Severe: piping, excess sodium.	Deep to water	Percs slowly, thin layer.	Area reclaim	Excess sodium, area reclaim, percs slowly.
Bp Bridgeport	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ca Cactusflat	Moderate: seepage.	Slight	Deep to water	Slow intake, percs slowly.	Favorable	Percs slowly.
Cb*:						
Cactusflat	Moderate: seepage.	Slight	Deep to water	Slow intake, percs slowly.	Favorable	Percs slowly.
Weta	Moderate: seepage.	Severe: excess sodium.	Deep to water	Percs slowly	Erodes easily	Erodes easily, excess sodium.
CeA Cedarpass	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Excess salt	Erodes easily	Erodes easily.
CfA*:						
Cedarpass	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Excess salt	Erodes easily	Erodes easily.
Denby	Moderate: seepage.	Slight	Deep to water	Slow intake, percs slowly.	Favorable	Percs slowly.
Ch*:						
Cedarpass	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Excess salt	Erodes easily	Erodes easily.
Interior	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Badland.						
ClF Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
CmC*:						
Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Norka	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Slope.
Cn Colombo	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Too sandy	Too arid.
Co Colombo	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Too sandy	Too arid.
Cp*:						
Colombo	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Too sandy	Too arid.
Urban land.						
CuD*:						
Conata	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
Hisle	Severe: slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, percs slowly.	Slope, area reclaim, erodes easily.	Slope, excess sodium, erodes easily.
CyC Cushman	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping.	Deep to water	Slope, depth to rock.	Depth to rock, erodes easily.	Too arid, erodes easily.
CzD*:						
Cushman	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Shingle	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Depth to rock, erodes easily.	Too arid, erodes easily.
DmA Denby	Moderate: seepage.	Slight	Deep to water	Slow intake, percs slowly.	Favorable	Percs slowly.
Eg Egas	Slight	Severe: hard to pack, wetness, excess salt.	Percs slowly, flooding, frost action.	Wetness, excess salt.	Wetness, percs slowly.	Excess salt, wetness, percs slowly.
EmA Emigrant	Moderate: seepage, depth to rock.	Moderate: thin layer, piping, hard to pack.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
EmB Emigrant	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Slope, depth to rock.	Depth to rock	Depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
EnD*:						
Enning	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Minnequa	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock, erodes easily.	Too arid, erodes easily.
FaE Fairburn	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
FgE Fairburn	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
FhE*:						
Fairburn	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Badland.						
FoF*:						
Fairburn	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Orella	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, percs slowly.	Slope, droughty, area reclaim.
Badland.						
Gb Glenberg	Severe: seepage.	Severe: piping.	Deep to water	Droughty	Too sandy, soil blowing.	Droughty.
GrE*:						
Grummit	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim.	Slope, droughty, area reclaim.
Rock outcrop.						
GsD*:						
Grummit	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim.	Slope, droughty, area reclaim.
Urban land.						
Ha, Hc Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
HpB Hisle	Moderate: seepage, slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, percs slowly.	Area reclaim, erodes easily.	Excess sodium, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
HrC*:						
Hisle	Moderate: seepage, slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, percs slowly.	Area reclaim, erodes easily.	Excess sodium, erodes easily.
Rock outcrop.						
HsB*:						
Hisle	Moderate: seepage, slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, percs slowly.	Area reclaim, erodes easily.	Excess sodium, erodes easily.
Slickspots.						
Hv Hoven	Slight	Severe: hard to pack, ponding, excess sodium.	Percs slowly, ponding, excess salt.	Ponding, percs slowly, excess sodium.	Wetness, percs slowly.	Percs slowly, wetness, excess sodium.
Hz Hoven Variant	Moderate: seepage.	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
In Interior	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Io Interior	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
IrB*:						
Interior	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Cedarpass	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Excess salt	Erodes easily	Erodes easily.
Denby	Moderate: seepage.	Slight	Deep to water	Slow intake, percs slowly.	Favorable	Percs slowly.
JaA Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
JaC Jayem	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
KtA, KyA Kyle	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, too arid.
KyB, KyC Kyle	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, too arid.
LaB Larvie	Moderate: seepage.	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, droughty.
LaD Larvie	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
LhC*:						
Larvie	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
Hisle	Moderate: seepage, slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, percs slowly.	Area reclaim, erodes easily.	Excess sodium, erodes easily.
Lo Lohmiller	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly, too arid.
Lp Lohmiller	Slight	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, percs slowly, flooding.	Percs slowly	Percs slowly, too arid.
MaB Manvel	Moderate: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
MeC*:						
Manvel	Moderate: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Minnequa	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock, erodes easily.	Too arid, erodes easily.
MgC*:						
Manvel	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Urban land.						
MoE Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
MosE Midway	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
MpD*:						
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Urban land.						
MrC*:						
Minnequa	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock, erodes easily.	Too arid, erodes easily.
Penrose	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Too arid, slope, depth to rock.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
NdE, NeD: Nihill	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope	Too arid, slope, droughty.
NgA: Norka	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
NgB: Norka	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
NhA*:						
Norka	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Weta	Moderate: seepage.	Severe: excess sodium.	Deep to water	Percs slowly	Erodes easily	Erodes easily, excess sodium.
NkD: Norrest	Severe: slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
NuA: Nunn	Slight	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
NuB, NuC: Nunn	Moderate: slope.	Moderate: thin layer, hard to pack.	Deep to water	Slope, percs slowly.	Percs slowly	Percs slowly.
NvA*:						
Nunn	Slight	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Beckton	Slight	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Too arid, excess salt, excess sodium.
NvC*:						
Nunn	Moderate: slope.	Moderate: thin layer, hard to pack.	Deep to water	Slope, percs slowly.	Percs slowly	Percs slowly.
Beckton	Moderate: slope.	Severe: excess sodium, excess salt.	Deep to water	Slope, percs slowly, excess sodium.	Percs slowly	Too arid, excess salt, excess sodium.
NwA*:						
Nunn	Slight	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Urban land.						
ObE*:						
Orella	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, percs slowly.	Slope, droughty, area reclaim.
Badland.						

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
OeE*:						
Orella	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, percs slowly.	Slope, droughty, area reclaim.
Interior	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Badland.						
OtA Ottumwa	Moderate: seepage.	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
OtB Ottumwa	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
OvC*:						
Ottumwa	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Erodes easily, droughty.
Razor	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slope, slow intake, percs slowly.	Depth to rock, erodes easily.	Too arid, erodes easily.
Ow Owanka	Slight	Severe: hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ox*:						
Owanka	Slight	Severe: hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
Beckton	Slight	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Too arid, excess salt, excess sodium.
PdF*:						
Penrose	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Too arid, slope, depth to rock.
Rock outcrop.						
PeB, PeC Pierre	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
PeD Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
PgD*:						
Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Grummit	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim.	Slope, droughty, area reclaim.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
PhB*:						
Pierre	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
Hisle	Moderate: seepage, slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, percs slowly.	Area reclaim, erodes easily.	Excess sodium, erodes easily.
PkC*:						
Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Urban land.						
Ps*. Pits						
RaB, RaC Razor	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slope, slow intake, percs slowly.	Depth to rock, erodes easily.	Too arid, erodes easily.
RbD*:						
Razor	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Midway	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Rv*. Riverwash						
SbF Samsil	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
ScE*:						
Samsil	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
SdF*:						
Samsil	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
Rock outcrop.						
SeA Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
SeB, SeC Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
SgA*:						
Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Beckton	Slight	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly	Too arid, excess salt, excess sodium.
SkA*:						
Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Urban land.						
SkB*:						
Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Urban land.						
SmA Savo	Slight	Moderate: hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
SmB, SmC Savo	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
SoB*:						
Savo	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.						
StE*:						
Schamber	Severe: slope, seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Samsil	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, droughty.
SuE Shingle	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
SvF*:						
Shingle	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Rock outcrop.						
SzB Swanboy	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Erodes easily, percs slowly.	Too arid, erodes easily.
TfA Tilford	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
VbD: Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Too arid, droughty.
VbwB*:						
Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Wortman	Moderate: seepage, slope.	Severe: hard to pack, excess sodium.	Deep to water	Slope, droughty, fast intake.	Area reclaim, soil blowing.	Excess sodium, droughty.
WaA: Wanblee	Moderate: seepage.	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Area reclaim	Area reclaim, excess salt, excess sodium.
WbB*:						
Wanblee	Moderate: seepage.	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Area reclaim	Area reclaim, excess salt, excess sodium.
Wortman	Moderate: seepage.	Severe: piping, excess sodium.	Deep to water	Percs slowly, thin layer.	Area reclaim	Excess sodium, area reclaim, percs slowly.
WeA: Weta	Moderate: seepage.	Severe: excess sodium.	Deep to water	Percs slowly	Erodes easily	Erodes easily, excess sodium.
Wh: Whitelake	Severe: seepage.	Severe: piping, excess sodium.	Percs slowly, frost action.	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Excess sodium, droughty, percs slowly.
WkA: Whitewater	Moderate: seepage.	Severe: hard to pack.	Deep to water	Droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, droughty.
WoB*:						
Whitewater	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, droughty.
Orella	Severe: seepage.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Area reclaim, percs slowly.	Droughty, area reclaim.
WwB: Wortman	Moderate: seepage, slope.	Severe: piping, excess sodium.	Deep to water	Slope, percs slowly, thin layer.	Area reclaim	Excess sodium, area reclaim, percs slowly.
ZnD*:						
Zigweid	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Too arid, slope, erodes easily.
Nihill	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope	Too arid, slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
AaA, AaB, AaC---- Altvan	0-7	Loam-------------	ML	A-4	0	100	100	85-100	60-90	25-35	2-10
	7-20	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	20-38	Loam, fine sandy loam, silt loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	2-10
	38-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	55-90	25-35	0-10	---	NP
ArA-------------- Arvada	0-2	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	70-80	20-30	5-15
	2-21	Clay, silty clay loam, clay loam.	CL, CH	A-7	0	80-100	75-100	70-100	65-95	40-65	20-35
	21-60	Clay loam, silty clay loam, clay.	CL	A-7	0	80-100	75-100	70-100	55-90	40-50	15-25
BaA-------------- Baca	0-5	Silt loam--------	CL-ML	A-4	0	100	100	85-95	70-90	20-30	5-10
	5-34	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0	100	100	90-100	75-95	35-45	15-25
	34-60	Loam, silt loam, silty clay loam.	CL-ML	A-4	0	100	100	85-95	70-90	25-30	5-10
Bb*. Badland											
BcB-------------- Bankard	0-7	Loamy fine sand	SM	A-2	0	100	80-100	70-85	20-30	---	NP
	7-60	Stratified fine sand to loam.	SM, SP-SM	A-2	0-5	80-100	75-85	65-75	15-35	---	NP
BfA-------------- Beckton	0-4	Silt loam--------	CL	A-6	0	90-100	85-100	80-100	70-90	30-40	15-25
	4-6	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SC-SM	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	6-18	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	18-28	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	28-60	Clay loam, silty clay, silty clay loam.	CL	A-7	0	80-100	75-95	65-90	60-85	30-50	15-30
BhA*: Beckton---------	0-4	Silt loam--------	CL	A-6	0	90-100	85-100	80-100	70-90	30-40	15-25
	4-6	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SC-SM	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	6-18	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	18-28	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	28-60	Silty clay, silty clay loam, silt loam.	CL	A-7	0	80-100	75-95	65-90	60-85	30-50	15-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BhA*:											
Arvada----------	0-2	Loam------------	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	70-80	20-30	5-15
	2-21	Clay, silty clay loam, clay loam.	CL, CH	A-7	0	80-100	75-100	70-100	65-95	40-65	20-35
	21-60	Clay loam, silty clay loam, clay.	CL	A-7	0	80-100	75-100	70-100	55-90	40-50	15-25
BkA, BkB--------- Blackpipe	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	5-15	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	15-27	Silty clay loam and silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	15-35
	27-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BlA, BlB--------- Blackpipe	0-5	Clay loam--------	ML, CL	A-6, A-7	0	100	100	95-100	75-95	35-50	15-25
	5-12	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	12-29	Clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	75-100	30-50	10-26
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BnC*:											
Blackpipe-------	0-5	Clay loam--------	ML, CL	A-6, A-7	0	100	100	95-100	75-95	35-50	15-25
	5-12	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	12-29	Clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	75-100	30-50	10-26
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Norrest---------	0-4	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	70-95	35-45	12-20
	4-29	Silty clay loam, clay loam, silty clay.	CL, CH	A-7	0	100	100	85-100	60-95	40-65	15-35
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BoA*:											
Blackpipe-------	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	75-95	35-50	15-25
	5-15	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	15-27	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	15-35
	27-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wortman---------	0-9	Silt loam--------	CL, ML	A-4, A-6	0	100	95-100	85-100	60-95	30-40	5-15
	9-16	Clay, clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-75	15-45
	16-32	Loam, silt loam, silty clay, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	75-100	30-50	10-26
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BoB*:											
Blackpipe-------	0-5	Clay loam--------	CL	A-6, A-7	0	100	100	95-100	75-95	35-50	15-25
	5-12	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	12-29	Clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	75-100	30-50	10-26
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wortman---------	0-5	Silt loam--------	CL, ML	A-4, A-6	0	100	95-100	85-100	60-95	30-40	5-15
	5-17	Clay, clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-75	15-45
	17-34	Clay loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-95	60-80	30-45	5-20
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bp--------------- Bridgeport	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	4-19
	16-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	90-100	65-100	25-40	8-20
Ca--------------- Cactusflat	0-4	Silty clay-------	CL, CH	A-7	0	100	100	95-100	80-100	45-65	20-35
	4-16	Silty clay, clay	CH	A-7	0	100	100	95-100	85-100	50-70	25-40
	16-22	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	45-65	20-35
	22-60	Stratified fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-100	35-50	15-30
Cb*:											
Cactusflat------	0-4	Silty clay-------	CL, CH	A-7	0	100	100	95-100	80-100	45-65	20-35
	4-16	Silty clay, clay	CH	A-7	0	100	100	95-100	85-100	50-70	25-40
	16-22	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	45-65	20-35
	22-60	Stratified fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-100	35-50	15-30
Weta------------	0-3	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	3-12	Clay, clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	12-21	Silty clay loam, silty clay, clay loam.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	21-60	Stratified very fine sandy loam to clay.	CL, CH	A-7	0	100	100	80-100	70-95	40-60	20-40
CeA-------------- Cedarpass	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	5-13	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-100	35-45	10-20
	13-34	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
	34-51	Loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	95-100	80-100	45-75	20-45
	51-60	Stratified very fine sandy loam to silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
CfA*:											
Cedarpass-------	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	5-13	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-100	35-45	10-20
	13-34	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
	34-51	Loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	95-100	80-100	45-75	20-45
	51-60	Stratified very fine sandy loam to silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
Denby-----------	0-3	Silty clay-------	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	3-22	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	22-60	Stratified silt loam to clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-30
Ch*:											
Cedarpass-------	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	5-13	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-100	35-45	10-20
	13-60	Stratified very fine sandy loam to silty clay.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
Interior--------	0-2	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	2-60	Stratified very fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
Badland.											
ClF-------------- Colby	0-6	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	6-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
CmC*:											
Colby-----------	0-6	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	6-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Norka-----------	0-7	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	85-95	60-85	20-35	2-10
	7-14	Silty clay loam, loam, clay loam.	CL	A-6	0	100	95-100	95-100	85-95	25-40	10-20
	14-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	75-95	20-30	NP-10
Cn, Co----------- Colombo	0-14	Loam-------------	ML	A-4	0	95-100	80-100	75-90	50-70	25-35	NP-10
	14-60	Stratified clay loam to sand.	ML	A-4, A-6	0-5	90-100	75-100	70-90	50-60	30-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Cp*:											
Colombo	0-14	Loam	ML	A-4	0	95-100	80-100	75-90	50-70	25-35	NP-10
	14-60	Stratified clay loam to sand.	ML	A-4, A-6	0-5	90-100	75-100	70-90	50-60	30-40	5-15
Urban land.											
CuD*:											
Conata	0-3	Silty clay	CH	A-7	0	95-100	95-100	90-100	80-100	50-75	25-45
	3-14	Clay, silty clay	CH	A-7	0	95-100	95-100	90-100	75-100	50-75	25-45
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hisle	0-2	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-28	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CyC Cushman	0-3	Loam	CL-ML, ML	A-4	0	90-100	90-100	70-85	60-70	20-30	NP-10
	3-10	Clay loam, loam	CL	A-6	0	90-100	90-100	80-90	70-80	30-40	10-20
	10-29	Loam, clay loam	CL	A-6	0	90-100	90-100	80-90	70-80	30-40	10-20
	29-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CzD*:											
Cushman	0-3	Loam	CL-ML, ML	A-4	0	90-100	90-100	70-85	60-70	20-30	NP-10
	3-10	Clay loam, loam	CL	A-6	0	90-100	90-100	80-90	70-80	30-40	10-20
	10-29	Loam, clay loam	CL	A-6	0	90-100	90-100	80-90	70-80	30-40	10-20
	29-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Shingle	0-3	Loam	ML	A-4	0-5	75-100	75-100	70-95	55-75	25-35	NP-10
	3-14	Clay loam, loam, silty clay loam.	CL	A-6	0	75-100	75-100	65-100	50-85	30-40	15-20
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
DmA Denby	0-3	Silty clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	3-22	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	22-60	Stratified silt loam to clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-30
Eg Egas	0-18	Silty clay loam	CH, MH	A-7	0	100	100	95-100	90-100	50-90	22-50
	18-60	Silty clay, silty clay loam, clay.	CH, MH	A-7	0	100	100	90-100	85-100	50-90	22-50
EmA, EmB Emigrant	0-6	Loam	CL	A-6	0	100	100	85-95	60-75	25-30	10-15
	6-20	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	20-33	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	33-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
EnD*:											
Enning	0-4	Silt loam	ML, MH	A-7	0	95-100	95-100	90-100	85-100	40-55	15-25
	4-18	Silt loam, silty clay loam.	ML, MH	A-7	0	95-100	95-100	90-100	90-100	40-55	15-25
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
EnD*:											
Minnequa--------	0-5	Silt loam--------	ML, CL-ML	A-4	0-1	95-100	95-100	80-100	65-90	20-30	NP-10
	5-26	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	95-100	80-90	25-40	5-20
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
FaE-------------- Fairburn	0-4	Clay loam--------	ML, CL	A-6, A-7	0	95-100	95-100	90-100	75-100	35-50	10-25
	4-15	Silty clay loam, silt loam, clay loam.	ML, CL	A-6, A-7	0	90-100	85-100	85-100	75-100	35-50	10-25
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
FgE-------------- Fairburn	0-4	Gravelly clay loam.	SM, SC, ML, CL	A-6, A-7	0-5	85-100	60-75	60-75	40-65	30-45	10-20
	4-15	Silty clay loam, silt loam, clay loam.	ML, CL	A-6, A-7	0	90-100	85-100	85-100	75-100	35-50	10-25
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
FhE*:											
Fairburn--------	0-4	Clay loam--------	ML, CL	A-6, A-7	0	95-100	95-100	90-100	75-100	35-50	10-25
	4-15	Silty clay loam, silt loam, clay loam.	ML, CL	A-6, A-7	0	90-100	85-100	85-100	75-100	35-50	10-25
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Badland.											
FoF*:											
Fairburn--------	0-4	Clay loam--------	ML, CL	A-6, A-7	0	95-100	95-100	90-100	75-100	35-50	10-25
	4-15	Silty clay loam, silt loam, clay loam.	ML, CL	A-6, A-7	0	90-100	85-100	85-100	75-100	35-50	10-25
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Orella----------	0-3	Clay-------------	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	3-14	Clay, clay loam	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Badland.											
Gb-------------- Glenberg	0-4	Fine sandy loam	SM	A-4, A-2	0	95-100	85-100	60-100	30-45	---	NP
	4-60	Stratified loamy sand to clay loam.	SM	A-2, A-4	0	90-100	75-100	50-100	25-40	---	NP
GrE*:											
Grummit---------	0-3	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	3-12	Clay-------------	CH, MH	A-7	0	95-100	85-100	75-100	65-100	50-65	15-30
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
GsD*:											
Grummit---------	0-3	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	3-12	Clay-------------	CH, MH	A-7	0	95-100	85-100	75-100	65-100	50-65	15-30
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
GsD*:											
Urban land.											
Ha---------------	0-5	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	55-90	25-35	NP-10
Haverson	5-60	Stratified silty clay loam to gravelly sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-70	25-40	5-15
Hc---------------	0-5	Loam-------------	ML	A-4	0	95-100	90-100	85-100	55-90	25-35	NP-10
Haverson	5-60	Stratified silty clay loam to gravelly sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-70	25-40	5-15
HpB--------------	0-2	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Hisle	2-28	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
HrC*:											
Hisle-----------	0-2	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-28	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
HsB*:											
Hisle-----------	0-2	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-28	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Slickspots.											
Hv---------------	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
Hoven	6-14	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	14-34	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	34-52	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
	52-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hz---------------	0-5	Silty clay-------	CH, MH	A-7	0	100	100	100	85-100	50-80	25-50
Hoven Variant	5-26	Clay-------------	CH, MH	A-7	0	100	100	100	85-100	55-85	25-50
	26-50	Clay-------------	CH, MH	A-7	0	100	100	100	85-100	55-85	25-50
	50-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
In---------------	0-2	Loam-------------	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	11-25
Interior	2-60	Stratified silt loam to silty clay.	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	11-25
Io---------------	0-2	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
Interior	2-60	Stratified very fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
IrB*:											
Interior	0-2	Loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	2-60	Stratified very fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
Cedarpass	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	5-13	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-100	35-45	10-20
	13-34	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
	34-51	Loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	95-100	80-100	45-75	20-45
	51-60	Stratified very fine sandy loam to silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
Denby	0-3	Silty clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	3-22	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	22-60	Stratified silt loam to clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-30
JaA, JaC	0-7	Fine sandy loam	SM	A-4, A-2	0	85-100	75-100	55-95	25-50	20-25	NP-5
Jayem	7-35	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	35-60	Loamy sand, loamy fine sand, sand.	SM	A-2	0	85-100	75-100	65-80	25-35	---	NP
KtA	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
Kyle	4-18	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
	18-60	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	25-55
KyA, KyB, KyC	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
Kyle	4-25	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
	25-60	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	25-55
LaB, LaD	0-3	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	30-45
Larvie	3-20	Clay	CH, MH	A-7	0	100	95-100	95-100	85-100	65-95	30-45
	20-29	Clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
LhC*:											
Larvie	0-3	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	30-45
	3-20	Clay	CH, MH	A-7	0	100	95-100	95-100	85-100	65-95	30-45
	20-29	Clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hisle	0-2	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-28	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Lo	0-6	Silty clay	CL, CH	A-7	0	100	100	95-100	85-100	45-60	20-30
Lohmiller	6-60	Stratified fine sandy loam to clay.	CL, CH	A-7	0	95-100	95-100	90-100	65-95	40-60	15-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Lp-------------- Lohmiller	0-6	Silty clay-------	CL, CH	A-7	0	100	100	95-100	85-100	45-60	20-30
	6-60	Stratified fine sandy loam to clay.	CL, ML	A-4, A-6	0	95-100	95-100	90-100	65-75	30-40	5-15
MaB------------- Manvel	0-4	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	70-90	25-35	5-15
	4-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0	85-100	85-100	85-100	80-90	20-40	5-20
MeC*:											
Manvel----------	0-4	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	70-90	25-35	5-15
	4-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0	85-100	85-100	85-100	80-90	20-40	5-20
Minnequa--------	0-5	Silt loam--------	ML, CL-ML	A-4	0-1	95-100	95-100	80-100	65-90	20-30	NP-10
	5-26	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	95-100	80-90	25-40	5-20
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
MgC*:											
Manvel----------	0-4	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	70-90	25-35	5-15
	4-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-4	0	85-100	85-100	85-100	80-90	20-40	5-20
Urban land.											
MoE------------- Midway	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-16	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
MosE------------ Midway	0-4	Stony clay loam	CL	A-6	15-35	80-95	75-90	70-85	50-70	20-40	10-25
	4-16	Clay, clay loam	CH, CL	A-7	0-15	85-100	80-100	70-100	55-95	45-60	20-30
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
MpD*:											
Midway----------	0-4	Clay loam--------	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-16	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
MrC*:											
Minnequa--------	0-5	Silt loam--------	ML, CL-ML	A-4	0-1	95-100	95-100	80-100	65-90	20-30	NP-10
	5-26	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	95-100	80-90	25-40	5-20
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Penrose---------	0-4	Loam-------------	ML, CL-ML	A-4	0-10	90-100	75-95	60-90	50-70	20-30	NP-10
	4-15	Loam, channery loam.	ML, CL-ML	A-4	5-25	90-100	75-95	60-90	50-70	20-30	NP-10
	15-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
NdE------------- Nihill	0-5	Gravelly loam----	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	5-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM-GC, GC, GP-GC	A-2, A-1	0-15	30-60	25-50	15-40	10-35	25-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NeD-------------- Nihill	0-60	Very gravelly loam.	GM, SM	A-1, A-2	0-5	45-65	30-50	20-40	15-35	20-35	NP-10
NgA, NgB--------- Norka	0-7	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	85-95	60-85	20-35	2-10
	7-14	Silty clay loam, loam, clay loam.	CL	A-6	0	100	95-100	95-100	85-95	25-40	10-20
	14-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	75-95	20-30	NP-10
NhA*:											
Norka-----------	0-7	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	85-95	60-85	20-35	2-10
	7-14	Silty clay loam, loam, clay loam.	CL	A-6	0	100	95-100	95-100	85-95	25-40	10-20
	14-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	75-95	20-30	NP-10
Weta------------	0-3	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	3-12	Clay, clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	12-21	Silty clay loam, silty clay, clay loam.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	21-60	Stratified very fine sandy loam to clay.	CL, CH	A-7	0	100	100	80-100	70-95	40-60	20-40
NkD-------------- Norrest	0-4	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	70-95	35-45	12-20
	4-29	Silty clay loam, clay loam, silty clay.	CL, CH	A-7	0	100	100	85-100	60-95	40-65	15-35
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
NuA, NuB, NuC---- Nunn	0-13	Loam-------------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
	13-29	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	29-60	Clay loam, loam, gravelly sandy loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20
NvA*, NvC*:											
Nunn------------	0-13	Loam-------------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
	13-29	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	29-60	Clay loam, loam, gravelly sandy loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
NvA*, NvC*:											
Beckton	0-4	Silt loam	CL	A-6	0	90-100	85-100	80-100	70-90	30-40	15-25
	4-6	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SC-SM	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	6-18	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	18-28	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	28-60	Silty clay, silty clay loam, clay loam.	CL	A-7, A-6	0	80-100	75-95	65-90	60-85	30-50	15-30
NwA*:											
Nunn	0-13	Loam	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
	13-29	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	29-60	Clay loam, loam, gravelly sandy loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20
Urban land.											
ObE*:											
Orella	0-3	Clay	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	3-14	Clay, clay loam	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Badland.											
OeE*:											
Orella	0-3	Clay	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	3-14	Clay, clay loam	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Interior	0-2	Loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	2-60	Stratified very fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
Badland.											
OtA, OtB	0-7	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	25-50
Ottumwa	7-25	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	25-50
	25-51	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-50
	51-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
OvC*:											
Ottumwa	0-7	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	25-50
	7-25	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	25-50
	25-51	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-50
	51-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
OvC*:											
Razor-----------	0-4	Silty clay-------	CL, CH	A-7	0-5	95-100	95-100	90-100	80-100	40-60	20-35
	4-15	Silty clay, silty clay loam, clay	CL, CH	A-6, A-7	0	100	95-100	90-100	80-100	35-60	20-45
	15-30	Silty clay, clay loam, clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	75-100	35-60	20-45
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ow--------------- Owanka	0-6	Clay loam--------	CL, MH, CH	A-7	0	95-100	90-100	90-100	85-95	40-55	15-30
	6-18	Silty clay loam, silty clay, clay loam.	CL, MH, CH	A-7	0	95-100	90-100	90-100	85-95	40-60	15-35
	18-35	Silty clay loam, silty clay, clay loam.	CL, MH, CH	A-7	0	95-100	90-100	90-100	85-95	40-60	15-35
	35-60	Silty clay loam, silty clay, clay loam.	CL, MH, CH	A-7	0	95-100	90-100	90-100	75-95	40-60	15-35
Ox*:											
Owanka----------	0-6	Clay loam--------	CL, MH, CH	A-7	0	95-100	90-100	90-100	85-95	40-55	15-30
	6-18	Silty clay loam, silty clay, clay loam.	CL, MH, CH	A-7	0	95-100	90-100	90-100	85-95	40-60	15-35
	18-35	Silty clay loam, silty clay, clay loam.	CL, MH, CH	A-7	0	95-100	90-100	90-100	85-95	40-60	15-35
	35-60	Silty clay loam, silty clay, clay loam.	CL, MH, CH	A-7	0	95-100	90-100	90-100	75-95	40-60	15-35
Beckton---------	0-4	Silt loam--------	CL	A-6	0	90-100	85-100	80-100	70-90	30-40	15-25
	4-6	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	6-18	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	18-28	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	28-60	Clay loam, silty clay, silty clay loam.	CL	A-7	0	80-100	75-95	65-90	60-85	30-50	15-30
PdF*:											
Penrose---------	0-4	Loam-------------	ML, CL-ML	A-4	0-10	90-100	75-95	60-90	50-70	20-30	NP-10
	4-15	Loam, channery loam.	ML, CL-ML	A-4	0-10	90-100	75-95	60-90	50-70	20-30	NP-10
	15-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
PeB, PeC, PeD---- Pierre	0-5	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	5-19	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	19-31	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
PgD*:											
Pierre----------	0-5	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	5-19	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	19-31	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Grummit---------	0-3	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	3-12	Clay-------------	CH, MH	A-7	0	95-100	85-100	75-100	65-100	50-65	15-30
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
PhB*:											
Pierre----------	0-5	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	5-19	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	19-31	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hisle-----------	0-2	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-28	Clay, silty clay	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
PkC*:											
Pierre----------	0-5	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	5-19	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	19-31	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
Ps*. Pits											
RaB, RaC--------- Razor	0-4	Silty clay-------	CL, CH	A-7	0-5	95-100	95-100	90-100	80-100	40-60	20-35
	4-15	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-100	35-60	20-45
	15-30	Silty clay, clay loam, clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	75-100	35-60	20-45
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RbD*:											
Razor-----------	0-4	Silty clay-------	CL, CH	A-7	0-5	95-100	95-100	90-100	80-100	40-60	20-35
	4-15	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-100	35-60	20-45
	15-30	Silty clay, clay loam, clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	75-100	35-60	20-45
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Midway----------	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-16	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rv*. Riverwash											
SbF-------------- Samsil	0-2	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	2-17	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	17-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ScE*:											
Samsil----------	0-2	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	2-17	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	17-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Pierre----------	0-5	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	5-19	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	19-31	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SdF*:											
Samsil----------	0-2	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	2-17	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	17-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Rock outcrop.											
SeA, SeB, SeC---- Satanta	0-11	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	11-22	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	22-60	Loam, clay loam, fine sandy loam.	CL, SC, ML, SM	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
SgA*:											
Satanta---------	0-11	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	11-22	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	22-60	Loam, clay loam, fine sandy loam.	CL, SC, ML, SM	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Beckton---------	0-4	Silt loam--------	CL	A-6	0	90-100	85-100	80-100	70-90	30-40	15-25
	4-6	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SC-SM	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	6-18	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	18-28	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	28-60	Silty clay, silty clay loam, clay loam.	CL	A-7, A-6	0	80-100	75-95	65-90	60-85	30-50	15-30
SkA*, SkB*:											
Satanta---------	0-11	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	11-22	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	22-60	Loam, clay loam, fine sandy loam.	CL, SC, ML, SM	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Urban land.											

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
SmA, SmB, SmC---- Savo	0-4	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	5-20
	4-14	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	15-35
	14-42	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	95-100	90-100	85-95	40-55	15-30
	42-60	Silty clay loam, silt loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-100	35-55	12-30
SoB*:											
Savo------------	0-4	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	5-20
	4-14	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	15-35
	14-42	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	95-100	90-100	85-95	40-55	15-30
	42-60	Silty clay loam, silt loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-100	35-55	12-30
Urban land.											
StE*:											
Schamber--------	0-4	Gravelly loam----	SM, SW-SM, GM, GW-GM	A-2, A-1	0-5	55-90	50-75	40-60	10-35	<25	NP-5
	4-60	Very gravelly sand, very gravelly loamy sand.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-80	25-50	5-20	0-10	<25	NP-5
Samsil----------	0-2	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	2-17	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	17-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
SuE-------------- Shingle	0-3	Loam-------------	ML	A-4	0-5	75-100	75-100	70-95	55-75	25-35	NP-10
	3-14	Clay loam, loam, silty clay loam.	CL	A-6	0	75-100	75-100	65-100	50-85	30-40	15-20
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SvF*:											
Shingle---------	0-3	Loam-------------	ML	A-4	0-5	75-100	75-100	70-95	55-75	25-35	NP-10
	3-14	Clay loam, loam, silty clay loam.	CL	A-6	0	75-100	75-100	65-100	50-85	30-40	15-20
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
SzB-------------- Swanboy	0-5	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	60-90	30-55
	5-60	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	65-90	30-55

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
TfA-------------- Tilford	0-7	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	7-29	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	29-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
VbD-------------- Valent	0-4	Loamy fine sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	---	NP
	4-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
VbwB*:											
Valent----------	0-4	Loamy fine sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	---	NP
	4-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
Wortman---------	0-13	Loamy fine sand	SM, SP-SM, SC-SM	A-2	0	100	100	65-95	10-30	<25	NP-5
	13-22	Sandy clay, clay loam, clay.	CL, CH	A-7	0	100	100	85-100	55-95	40-70	15-40
	22-31	Clay, clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-75	15-45
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
WaA-------------- Wanblee	0-3	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	60-95	25-40	3-15
	3-8	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-85	40-70	15-45
	8-29	Clay loam, loam	CL	A-6, A-7	0	100	95-100	90-100	65-85	35-50	15-30
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
WbB*:											
Wanblee---------	0-3	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	60-95	25-40	3-15
	3-8	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-85	40-70	15-45
	8-29	Clay loam, loam	CL	A-6, A-7	0	100	95-100	90-100	65-85	35-50	15-30
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wortman---------	0-5	Silt loam--------	CL, ML	A-4, A-6	0	100	95-100	85-100	60-95	30-40	5-15
	5-17	Clay, clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-75	15-45
	17-34	Clay loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-95	60-80	30-45	5-20
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
WeA-------------- Weta	0-3	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	3-12	Clay, clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	12-21	Silty clay loam, silty clay, clay loam.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	21-60	Stratified very fine sandy loam to clay.	CL, CH	A-7	0	100	100	80-100	70-95	40-60	20-40

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Wh--------------- Whitelake	0-7	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-2, A-4	0	100	100	70-100	30-55	<25	NP-5
	7-10	Fine sandy loam, sandy loam, loamy fine sand.	SM, SC-SM	A-2, A-4	0	100	100	70-100	30-50	<25	NP-5
	10-27	Sandy clay loam, fine sandy loam.	SC-SM, CL-ML, SC, CL	A-4, A-6	0	100	100	60-100	35-55	25-40	6-20
	27-60	Stratified sand to silt loam.	ML, CL, SC-SM, CL-ML	A-2, A-4, A-6	0	100	95-100	60-100	20-65	15-35	NP-12
WkA-------------- Whitewater	0-3	Clay-------------	CH, MH	A-7	0	100	95-100	95-100	80-100	60-85	30-45
	3-16	Clay-------------	CH	A-7	0	100	95-100	95-100	80-100	70-100	40-65
	16-26	Clay-------------	CH	A-7	0	100	95-100	95-100	80-100	70-100	40-65
	26-33	Clay-------------	CH	A-7	0	100	95-100	90-100	80-100	60-80	30-45
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
WoB*:											
Whitewater------	0-3	Clay-------------	CH, MH	A-7	0	100	95-100	95-100	80-100	60-85	30-45
	3-16	Clay-------------	CH	A-7	0	100	95-100	95-100	80-100	70-100	40-65
	16-26	Clay-------------	CH	A-7	0	100	95-100	95-100	80-100	70-100	40-65
	26-33	Clay-------------	CH	A-7	0	100	95-100	90-100	80-100	60-80	30-45
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Orella----------	0-3	Clay-------------	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	3-14	Clay, clay loam	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
WwB-------------- Wortman	0-5	Silt loam--------	CL, ML	A-4, A-6	0	100	95-100	85-100	60-95	30-40	5-15
	5-17	Clay, clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-75	15-45
	17-34	Clay loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-95	60-80	30-45	5-20
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ZnD*:											
Zigweid---------	0-10	Loam-------------	CL	A-6	0	75-100	75-100	70-85	60-70	25-35	10-15
	10-60	Loam, clay loam	CL	A-6	0	75-100	75-100	70-85	60-70	25-40	10-20
ZnD*:											
Nihill----------	0-5	Gravelly loam----	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	5-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM-GC, GC, GP-GC	A-2, A-1	0-15	30-60	25-50	15-40	10-35	25-40	5-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
AaA, AaB, AaC----	0-7	16-23	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.28	4	5	1-3
Altvan	7-20	20-35	1.20-1.50	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	20-38	8-15	1.30-1.50	0.6-2.0	0.17-0.19	7.4-9.0	<2	Low--------	0.32			
	38-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-9.0	<2	Low--------	0.10			
ArA--------------	0-2	15-27	1.10-1.25	0.6-2.0	0.16-0.18	6.6-9.0	<4	Low--------	0.37	3	6	.5-1
Arvada	2-21	35-60	1.20-1.40	<0.06	0.07-0.09	>7.8	<2	High-------	0.32			
	21-60	28-45	1.20-1.40	0.06-0.2	0.09-0.11	>7.8	<4	High-------	0.32			
BaA--------------	0-5	15-27	1.30-1.35	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low--------	0.32	5	6	1-3
Baca	5-34	35-45	1.35-1.40	0.2-0.6	0.16-0.18	6.6-8.4	<2	Moderate	0.32			
	34-60	15-35	1.35-1.45	0.6-2.0	0.16-0.18	7.9-9.0	<2	Moderate	0.37			
Bb*.												
Badland												
BcB--------------	0-7	2-8	1.55-1.65	6.0-20	0.07-0.09	7.4-8.4	<2	Low--------	0.10	5	2	1-2
Bankard	7-60	2-10	1.55-1.65	6.0-20	0.05-0.08	7.4-8.4	<2	Low--------	0.20			
BfA--------------	0-4	25-40	1.30-1.40	0.2-0.6	0.10-0.13	6.1-8.4	<8	Moderate	0.37	3	6	1-3
Beckton	4-6	10-20	1.40-1.45	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low--------	0.20			
	6-18	35-50	1.40-1.50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High-------	0.28			
	18-28	35-50	1.40-1.50	<0.2	0.09-0.12	7.4-9.0	>4	High-------	0.28			
	28-60	35-50	1.30-1.45	<0.2	0.10-0.13	>7.4	>4	High-------	0.28			
BhA*:												
Beckton---------	0-4	25-40	1.30-1.40	0.2-0.6	0.10-0.13	6.1-8.4	<8	Moderate	0.32	3	6	1-3
	4-6	10-20	1.40-1.45	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low--------	0.20			
	6-18	35-50	1.40-1.50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High-------	0.28			
	18-28	35-50	1.40-1.50	<0.2	0.09-0.12	7.4-9.0	>4	High-------	0.28			
	28-60	35-50	1.30-1.45	<0.2	0.10-0.13	>7.4	>4	High-------	0.28			
Arvada----------	0-2	15-27	1.10-1.25	0.6-2.0	0.16-0.18	6.6-9.0	<4	Low--------	0.32	3	5	.5-1
	2-21	35-60	1.20-1.40	<0.06	0.07-0.09	>7.8	<2	High-------	0.32			
	21-60	28-45	1.20-1.40	0.06-0.2	0.09-0.11	>7.8	<4	High-------	0.32			
BkA, BkB---------	0-5	27-33	1.15-1.30	0.2-0.6	0.16-0.22	6.1-7.8	<2	Moderate	0.32	4	7	2-4
Blackpipe	5-15	35-50	1.25-1.40	0.2-0.6	0.11-0.19	6.6-7.8	<2	High-------	0.32			
	15-27	28-45	1.30-1.45	0.2-0.6	0.13-0.20	7.4-8.4	<2	Moderate	0.32			
	27-60	---	---	---	---	---	---	----------	----			
BlA, BlB---------	0-5	27-33	1.15-1.30	0.2-0.6	0.16-0.22	6.1-7.8	<2	Moderate	0.28	4	6	2-4
Blackpipe	5-12	35-50	1.25-1.40	0.2-0.6	0.11-0.19	6.6-7.8	<2	High-------	0.32			
	12-29	20-40	1.30-1.45	0.2-0.6	0.13-0.20	7.4-8.4	<2	Moderate	0.32			
	29-60	---	---	---	---	---	---	----------	----			
BnC*:												
Blackpipe-------	0-5	27-33	1.15-1.30	0.2-0.6	0.16-0.22	6.1-7.8	<2	Moderate	0.28	4	6	2-4
	5-12	35-50	1.25-1.40	0.2-0.6	0.11-0.19	6.6-7.8	<2	High-------	0.32			
	12-29	20-40	1.30-1.45	0.2-0.6	0.13-0.20	7.4-8.4	<2	Moderate	0.32			
	29-60	---	---	---	---	---	---	----------	----			
Norrest---------	0-4	27-34	1.15-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.32	4	4L	2-4
	4-29	35-45	1.20-1.40	0.2-0.6	0.11-0.17	7.4-8.4	<2	High-------	0.37			
	29-60	---	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
BoA*:												
Blackpipe-------	0-5	27-33	1.15-1.30	0.2-0.6	0.16-0.22	6.1-7.8	<2	Moderate	0.32	4	7	2-4
	5-15	35-50	1.25-1.40	0.2-0.6	0.11-0.19	6.6-7.8	<2	High------	0.32			
	15-27	28-45	1.30-1.45	0.2-0.6	0.13-0.20	7.4-8.4	<2	Moderate	0.32			
	27-60	---	---	---	---	---	---	----------	----			
Wortman---------	0-9	10-20	1.15-1.30	0.6-2.0	0.18-0.22	6.1-7.8	<2	Low-------	0.37	3	5	2-4
	9-16	35-50	1.05-1.15	<0.06	0.08-0.14	6.6-8.4	4-16	High------	0.32			
	16-32	20-45	1.20-1.30	0.2-0.6	0.13-0.15	7.4-9.0	2-16	Moderate	0.32			
	32-60	---	---	---	---	---	---	----------	----			
BoB*:												
Blackpipe-------	0-5	27-33	1.15-1.30	0.2-0.6	0.16-0.22	6.1-7.8	<2	Moderate	0.32	4	6	2-4
	5-12	35-50	1.25-1.40	0.2-0.6	0.11-0.19	6.6-7.8	<2	High------	0.32			
	12-29	20-40	1.30-1.45	0.2-0.6	0.13-0.20	7.4-8.4	<2	Moderate	0.32			
	29-60	---	---	---	---	---	---	----------	----			
Wortman---------	0-5	10-20	1.15-1.30	0.6-2.0	0.18-0.22	6.1-7.8	<2	Low-------	0.37	3	5	2-4
	5-17	35-50	1.05-1.15	<0.06	0.08-0.14	6.6-8.4	4-16	High------	0.32			
	17-34	28-40	1.20-1.30	0.2-0.6	0.13-0.15	7.4-9.0	2-16	Moderate	0.32			
	34-60	---	---	---	---	---	---	----------	----			
Bp--------------- Bridgeport	0-16	14-27	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	4L	1-4
	16-60	18-30	1.35-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low-------	0.43			
Ca--------------- Cactusflat	0-4	40-50	1.15-1.30	0.06-0.2	0.10-0.14	6.6-8.4	<2	High------	0.28	5	4	2-4
	4-16	40-60	1.20-1.35	0.06-0.2	0.08-0.13	7.4-8.4	<4	Very high	0.32			
	16-22	30-50	1.25-1.40	0.06-0.2	0.10-0.17	7.4-8.4	<8	High------	0.32			
	22-60	20-40	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.32			
Cb*:												
Cactusflat------	0-4	40-50	1.15-1.30	0.06-0.2	0.10-0.14	6.6-8.4	<2	High------	0.28	5	4	2-4
	4-16	40-60	1.20-1.35	0.06-0.2	0.08-0.13	7.4-8.4	<4	Very high	0.32			
	16-22	30-50	1.25-1.40	0.06-0.2	0.10-0.17	7.4-8.4	<8	High------	0.32			
	22-60	20-40	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.32			
Weta------------	0-3	15-25	1.25-1.45	0.6-2.0	0.16-0.19	5.1-7.8	<2	Low-------	0.37	2	6	1-3
	3-12	35-50	1.20-1.40	<0.2	0.10-0.16	6.6-8.4	<4	High------	0.32			
	12-21	30-45	1.20-1.40	0.06-0.6	0.08-0.14	7.4-9.0	2-8	Moderate	0.32			
	21-60	25-34	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.43			
CeA-------------- Cedarpass	0-5	27-35	1.00-1.15	0.2-0.6	0.16-0.19	6.1-7.8	<4	Moderate	0.32	5	4L	1-3
	5-13	18-30	1.15-1.35	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate	0.43			
	13-34	18-30	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low-------	0.43			
	34-51	25-50	1.20-1.35	0.2-0.6	0.13-0.17	7.4-9.0	<4	Moderate	0.43			
	51-60	18-30	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.43			
CfA*:												
Cedarpass-------	0-5	27-35	1.00-1.15	0.2-0.6	0.16-0.19	6.1-7.8	<4	Moderate	0.32	5	4L	1-3
	5-13	18-30	1.15-1.35	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate	0.43			
	13-34	18-30	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low-------	0.43			
	34-51	25-50	1.20-1.35	0.2-0.6	0.13-0.17	7.4-9.0	<4	Moderate	0.43			
	51-60	18-30	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.43			
Denby-----------	0-3	40-50	1.15-1.30	0.06-0.2	0.08-0.12	6.6-8.4	<2	High------	0.28	5	4	1-3
	3-22	35-50	1.20-1.35	0.06-0.2	0.08-0.12	7.4-8.4	<4	High------	0.32			
	22-60	20-34	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<4	Moderate	0.32			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ch*:												
Cedarpass--------	0-5	27-35	1.00-1.15	0.2-0.6	0.16-0.19	6.1-7.8	<4	Moderate	0.32	5	4L	1-3
	5-13	18-30	1.15-1.35	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate	0.43			
	13-60	18-30	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low--------	0.43			
Interior---------	0-2	15-26	1.15-1.25	0.6-2.0	0.16-0.19	7.4-9.0	<2	Low--------	0.32	5	4L	<1
	2-60	20-35	1.25-1.40	0.2-2.0	0.14-0.17	7.9-9.0	<4	Low--------	0.43			
Badland.												
ClF--------------- Colby	0-6	15-30	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	.5-2
	6-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
CmC*:												
Colby------------	0-6	15-30	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	.5-2
	6-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Norka------------	0-7	15-27	1.15-1.30	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low--------	0.32	5	6	2-3
	7-14	18-35	1.20-1.35	0.2-0.6	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	14-60	15-35	1.25-1.40	0.6-2.0	0.16-0.21	7.4-8.4	<2	Low--------	0.32			
Cn, Co------------ Colombo	0-14	15-25	1.35-1.45	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low--------	0.28	5	5	2-4
	14-60	18-35	1.35-1.45	0.6-2.0	0.14-0.16	7.4-9.0	<2	Low--------	0.28			
Cp*:												
Colombo----------	0-14	15-25	1.35-1.45	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low--------	0.28	5	5	2-4
	14-60	18-35	1.35-1.45	0.6-2.0	0.14-0.16	7.4-9.0	<2	Low--------	0.28			
Urban land.												
CuD*:												
Conata-----------	0-3	40-55	1.15-1.25	<0.06	0.08-0.14	6.6-7.8	<2	Very high	0.37	2	4	1-3
	3-14	45-55	1.15-1.25	<0.06	0.08-0.14	6.6-8.4	<4	Very high	0.37			
	14-60	---	---	---	---	---	---	-----------	----			
Hisle------------	0-2	18-27	1.10-1.25	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low--------	0.37	3	6	1-3
	2-28	50-60	1.25-1.40	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	28-60	---	---	---	---	---	---	-----------	----			
CyC--------------- Cushman	0-3	10-20	1.20-1.30	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.28	3	5	1-2
	3-10	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.37			
	10-29	20-35	1.25-1.35	0.6-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.37			
	29-60	---	---	---	---	---	---	-----------	----			
CzD*:												
Cushman----------	0-3	10-20	1.20-1.30	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.28	3	5	1-2
	3-10	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.37			
	10-29	20-35	1.25-1.35	0.6-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.37			
	29-60	---	---	---	---	---	---	-----------	----			
Shingle----------	0-3	18-27	1.20-1.25	0.6-2.0	0.16-0.18	7.4-9.0	<2	Low--------	0.28	2	4L	1-3
	3-14	20-35	1.30-1.40	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate	0.49			
	14-60	---	---	---	---	---	---	-----------	----			
DmA--------------- Denby	0-3	40-50	1.15-1.30	0.06-0.2	0.08-0.12	6.6-8.4	<2	High-------	0.28	5	4	1-3
	3-22	35-50	1.20-1.35	0.06-0.2	0.08-0.12	7.4-8.4	<4	High-------	0.32			
	22-60	20-34	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<4	Moderate	0.32			
Eg---------------- Egas	0-18	35-50	1.15-1.30	0.06-0.2	0.10-0.15	7.4-9.0	>8	High-------	0.37	5	8	2-4
	18-60	35-50	1.25-1.40	0.06-0.2	0.08-0.13	7.9-9.0	>8	High-------	0.28			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
EmA, EmB: Emigrant	0-6	22-27	1.15-1.25	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	0.28	3	6	1-4
	6-20	35-55	1.20-1.30	0.2-0.6	0.15-0.17	6.6-8.4	<2	High	0.24			
	20-33	35-55	1.20-1.30	0.2-0.6	0.15-0.17	7.9-8.4	<2	High	0.24			
	33-60	---	---	---	---	---	---	---	---			
EnD*:												
Enning	0-4	18-26	1.10-1.25	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low	0.32	2	4L	1-3
	4-18	18-35	1.20-1.35	0.6-2.0	0.14-0.17	7.4-8.4	<2	Low	0.43			
	18-60	---	---	---	---	---	---	---	---			
Minnequa	0-5	15-27	1.30-1.40	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low	0.32	3	4L	.5-2
	5-26	18-35	1.35-1.40	0.6-2.0	0.16-0.18	7.4-9.0	<4	Moderate	0.37			
	26-60	---	---	---	---	---	---	---	---			
FaE: Fairburn	0-4	25-35	1.15-1.25	0.6-2.0	0.19-0.22	6.6-8.4	<2	Moderate	0.32	2	4L	1-3
	4-15	25-35	1.20-1.35	0.2-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.43			
	15-60	---	---	---	---	---	---	---	---			
FgE: Fairburn	0-4	27-35	1.20-1.30	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	0.32	2	8	1-3
	4-15	25-35	1.20-1.35	0.2-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.43			
	15-60	---	---	---	---	---	---	---	---			
FhE*:												
Fairburn	0-4	25-35	1.15-1.25	0.6-2.0	0.19-0.22	6.6-8.4	<2	Moderate	0.32	2	4L	1-3
	4-15	25-35	1.20-1.35	0.2-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.43			
	15-60	---	---	---	---	---	---	---	---			
Badland.												
FoF*:												
Fairburn	0-4	25-35	1.15-1.25	0.6-2.0	0.19-0.22	6.6-8.4	<2	Moderate	0.32	2	4L	1-3
	4-15	25-35	1.20-1.35	0.2-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.43			
	15-60	---	---	---	---	---	---	---	---			
Orella	0-3	40-50	1.00-1.20	0.06-0.2	0.09-0.11	7.4-8.4	<4	High	0.32	2	4L	.5-1
	3-14	38-65	1.00-1.20	<0.06	0.09-0.11	7.4-9.0	4-16	High	0.32			
	14-60	---	---	---	---	---	---	---	---			
Badland.												
Gb: Glenberg	0-4	10-20	1.45-1.50	2.0-6.0	0.09-0.13	7.4-8.4	<2	Low	0.20	5	3	.5-1
	4-60	8-18	1.45-1.50	2.0-6.0	0.07-0.12	7.4-9.0	<2	Low	0.15			
GrE*:												
Grummit	0-3	40-65	1.15-1.30	0.2-0.6	0.08-0.17	3.6-5.5	<2	High	0.37	2	4	1-2
	3-12	40-65	1.10-1.25	0.6-2.0	0.08-0.17	3.6-5.5	<2	High	0.28			
	12-60	---	---	---	---	---	---	---	---			
Rock outcrop.												
GsD*:												
Grummit	0-3	40-65	1.15-1.30	0.2-0.6	0.08-0.17	3.6-5.5	<2	High	0.28	2	4	1-2
	3-12	40-65	1.10-1.25	0.6-2.0	0.08-0.17	3.6-5.5	<2	High	0.28			
	12-60	---	---	---	---	---	---	---	---			
Urban land.												
Ha, Hc: Haverson	0-5	10-26	1.20-1.35	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low	0.32	5	4L	1-3
	5-60	18-35	1.30-1.45	0.6-2.0	0.14-0.18	7.4-9.0	2-4	Low	0.28			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
HpB--------------	0-2	18-27	1.10-1.25	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low--------	0.28	3	6	1-3
Hisle	2-28	50-60	1.25-1.40	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	28-60	---	---	---	---	---	---	----------	----			
HrC*:												
Hisle-----------	0-2	18-27	1.10-1.25	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low--------	0.28	3	6	1-3
	2-28	50-60	1.25-1.40	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	28-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
HsB*:												
Hisle-----------	0-2	18-27	1.10-1.25	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low--------	0.28	3	6	1-3
	2-28	50-60	1.25-1.40	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	28-60	---	---	---	---	---	---	----------	----			
Slickspots.												
Hv---------------	0-6	22-26	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.37	3	7	2-4
Hoven	6-14	35-60	1.15-1.30	<0.06	0.10-0.19	6.1-7.8	4-16	High-------	0.37			
	14-34	35-60	1.15-1.30	<0.06	0.10-0.19	7.4-8.4	4-16	High-------	0.37			
	34-52	35-60	1.30-1.50	<0.2	0.08-0.17	7.4-9.0	4-16	High-------	0.37			
	52-60	---	---	---	---	---	---	----------	----			
Hz---------------	0-5	40-50	1.15-1.30	<0.06	0.13-0.18	7.4-7.8	<2	Very high	0.37	4	8	2-4
Hoven Variant	5-26	45-60	1.25-1.40	<0.06	0.08-0.12	7.4-7.8	<2	Very high	0.37			
	26-50	45-60	1.35-1.50	<0.06	0.08-0.12	7.4-7.8	<2	Very high	0.37			
	50-60	---	---	---	---	---	---	----------	----			
In---------------	0-2	18-27	1.15-1.30	0.2-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.32	5	4L	.5-1
Interior	2-60	20-35	1.20-1.35	0.2-2.0	0.17-0.20	7.9-9.0	<4	Moderate	0.32			
Io---------------	0-2	15-26	1.15-1.25	0.6-2.0	0.16-0.19	7.4-9.0	<2	Low--------	0.32	5	4L	<1
Interior	2-60	20-35	1.25-1.40	0.2-2.0	0.14-0.17	7.9-9.0	<4	Low--------	0.43			
IrB*:												
Interior--------	0-2	15-26	1.15-1.25	0.6-2.0	0.16-0.19	7.4-9.0	<2	Low--------	0.32	5	4L	<1
	2-60	20-35	1.25-1.40	0.2-2.0	0.14-0.17	7.9-9.0	<4	Low--------	0.43			
Cedarpass-------	0-5	27-35	1.00-1.15	0.2-0.6	0.16-0.19	6.1-7.8	<4	Moderate	0.32	5	4L	1-3
	5-13	18-30	1.15-1.35	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate	0.43			
	13-34	18-30	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low--------	0.43			
	34-51	25-50	1.20-1.35	0.2-0.6	0.13-0.17	7.4-9.0	<4	Moderate	0.43			
	51-60	18-30	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.43			
Denby-----------	0-3	40-50	1.15-1.30	0.06-0.2	0.08-0.12	6.6-8.4	<2	High-------	0.28	5	4	1-3
	3-22	35-50	1.20-1.35	0.06-0.2	0.08-0.12	7.4-8.4	<4	High-------	0.32			
	22-60	20-34	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<4	Moderate	0.32			
JaA, JaC---------	0-7	5-15	1.20-1.35	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.20	5	3	1-3
Jayem	7-35	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.28			
	35-60	3-10	1.45-1.60	2.0-6.0	0.07-0.09	6.6-7.8	<2	Low--------	0.24			
KtA--------------	0-4	50-65	1.15-1.30	<0.06	0.08-0.12	6.6-7.8	<2	Very high	0.37	5	4	1-3
Kyle	4-18	60-65	1.15-1.30	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37			
	18-60	60-65	1.15-1.30	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
KyA, KyB, KyC----	0-4	50-65	1.15-1.30	<0.06	0.08-0.12	6.6-7.8	<2	Very high	0.37	5	4	1-3
Kyle	4-25	60-65	1.15-1.30	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37			
	25-60	60-65	1.15-1.30	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
LaB, LaD: Larvie	0-3	55-70	1.15-1.30	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37	4	4	2-4
	3-20	60-70	1.20-1.35	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	20-29	60-70	1.25-1.40	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	29-60	---	---	---	---	---	---	---	---			
LhC*:												
Larvie	0-3	55-70	1.15-1.30	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37	4	4	2-4
	3-20	60-70	1.20-1.35	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	20-29	60-70	1.25-1.40	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	29-60	---	---	---	---	---	---	---	---			
Hisle	0-2	18-27	1.10-1.25	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low	0.28	3	6	1-3
	2-28	50-60	1.25-1.40	0.01-0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	28-60	---	---	---	---	---	---	---	---			
Lo: Lohmiller	0-6	40-50	1.15-1.25	0.06-0.6	0.11-0.16	6.6-8.4	<4	High	0.28	5	4	1-3
	6-60	35-50	1.30-1.45	0.06-0.6	0.14-0.16	7.4-8.4	<8	High	0.32			
Lp: Lohmiller	0-6	40-50	1.15-1.25	0.06-0.2	0.11-0.16	6.6-8.4	<4	High	0.28	5	4	1-3
	6-60	25-40	1.30-1.45	0.06-0.6	0.14-0.16	7.4-8.4	<4	High	0.32			
MaB: Manvel	0-4	15-27	1.30-1.40	0.6-2.0	0.18-0.20	7.9-8.4	<2	Moderate	0.32	5	4L	.5-2
	4-60	18-35	1.35-1.40	0.2-0.6	0.16-0.18	7.9-8.4	2-4	Moderate	0.43			
MeC*:												
Manvel	0-4	15-27	1.30-1.40	0.6-2.0	0.18-0.20	7.9-8.4	<2	Moderate	0.32	5	4L	.5-2
	4-60	18-35	1.35-1.40	0.2-0.6	0.16-0.18	7.9-8.4	2-4	Moderate	0.43			
Minnequa	0-5	15-27	1.30-1.40	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low	0.37	3	4L	.5-2
	5-26	18-35	1.35-1.40	0.6-2.0	0.16-0.18	7.4-9.0	<4	Moderate	0.37			
	26-60	---	---	---	---	---	---	---	---			
MgC*:												
Manvel	0-4	15-27	1.30-1.40	0.6-2.0	0.18-0.20	7.9-8.4	<2	Moderate	0.37	5	4L	.5-2
	4-60	18-35	1.35-1.40	0.2-0.6	0.16-0.18	7.9-8.4	2-4	Moderate	0.43			
Urban land.												
MoE: Midway	0-4	30-40	1.25-1.35	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.37	2	4L	.5-2
	4-16	35-45	1.20-1.35	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High	0.43			
	16-60	---	---	---	---	---	---	---	---			
MosE: Midway	0-4	27-40	1.25-1.35	0.06-0.2	0.15-0.17	7.4-8.4	<2	Moderate	0.37	2	8	.5-1
	4-16	35-45	1.20-1.30	0.06-0.2	0.15-0.18	7.4-9.0	<2	High	0.28			
	16-60	---	---	---	---	---	---	---	---			
MpD*:												
Midway	0-4	30-40	1.25-1.35	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.37	2	4L	.5-2
	4-16	35-45	1.20-1.35	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High	0.43			
	16-60	---	---	---	---	---	---	---	---			
Urban land.												
MrC*:												
Minnequa	0-5	15-27	1.30-1.40	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low	0.32	3	4L	.5-2
	5-26	18-35	1.35-1.40	0.6-2.0	0.16-0.18	7.4-9.0	<4	Moderate	0.37			
	26-60	---	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
MrC*:												
Penrose---------	0-4	15-27	1.35-1.45	0.6-2.0	0.15-0.18	7.9-8.4	<2	Low--------	0.32	1	4L	.5-1
	4-15	15-30	1.35-1.45	0.6-2.0	0.15-0.18	7.9-8.4	<2	Low--------	0.24			
	15-60	---	---	---	---	---	---	-----------	----			
NdE-------------- Nihill	0-5	10-27	1.15-1.25	0.6-2.0	0.12-0.16	6.6-8.4	<2	Low--------	0.24	2	8	.5-1
	5-60	18-30	1.30-1.40	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low--------	0.05			
NeD-------------- Nihill	0-60	10-27	1.15-1.25	2.0-6.0	0.08-0.12	6.6-7.8	<2	Low--------	0.20	2	6	.5-1
NgA, NgB--------- Norka	0-7	15-27	1.15-1.30	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low--------	0.32	5	6	2-3
	7-14	18-35	1.20-1.35	0.2-0.6	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	14-60	15-35	1.25-1.40	0.6-2.0	0.16-0.21	7.4-8.4	<2	Low--------	0.32			
NhA*:												
Norka-----------	0-7	15-27	1.15-1.30	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low--------	0.32	5	6	2-3
	7-14	18-35	1.20-1.35	0.2-0.6	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	14-60	15-35	1.25-1.40	0.6-2.0	0.16-0.21	7.4-8.4	<2	Low--------	0.32			
Weta------------	0-3	15-25	1.25-1.45	0.6-2.0	0.16-0.19	5.1-7.8	<2	Low--------	0.37	2	6	1-3
	3-12	35-50	1.20-1.40	<0.2	0.10-0.16	6.6-8.4	<4	High-------	0.32			
	12-21	30-45	1.20-1.40	0.06-0.6	0.08-0.14	7.4-9.0	2-8	Moderate	0.32			
	21-60	25-34	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.43			
NkD-------------- Norrest	0-4	27-34	1.15-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.32	4	4L	2-4
	4-29	35-45	1.20-1.40	0.2-0.6	0.11-0.17	7.4-8.4	<2	High-------	0.37			
	29-60	---	---	---	---	---	---	-----------	----			
NuA, NuB, NuC---- Nunn	0-13	20-30	1.30-1.40	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	13-29	35-50	1.25-1.35	0.06-0.2	0.15-0.18	6.6-8.4	<2	High-------	0.28			
	29-60	15-30	1.25-1.40	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate	0.24			
NvA*, NvC*:												
Nunn------------	0-13	20-30	1.30-1.40	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate	0.28	5	6	1-3
	13-29	35-50	1.25-1.35	0.06-0.2	0.15-0.18	6.6-8.4	<2	High-------	0.28			
	29-60	15-30	1.25-1.40	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate	0.24			
Beckton---------	0-4	25-40	1.30-1.40	0.2-0.6	0.10-0.13	6.1-8.4	<8	Moderate	0.37	3	6	1-3
	4-6	10-20	1.40-1.45	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low--------	0.20			
	6-18	35-50	1.40-1.50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High-------	0.28			
	18-28	35-50	1.40-1.50	<0.2	0.09-0.12	7.4-9.0	>4	High-------	0.28			
	28-60	35-50	1.30-1.45	<0.2	0.10-0.13	>7.4	>4	High-------	0.28			
NwA*:												
Nunn------------	0-13	20-30	1.30-1.40	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate	0.24	5	6	1-3
	13-29	35-50	1.25-1.35	0.06-0.2	0.15-0.18	6.6-8.4	<2	High-------	0.28			
	29-60	15-30	1.25-1.40	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate	0.24			
Urban land.												
ObE*:												
Orella----------	0-3	40-50	1.00-1.20	0.06-0.2	0.09-0.11	7.4-8.4	<4	High-------	0.37	2	4	.5-1
	3-14	38-65	1.00-1.20	<0.06	0.09-0.11	7.4-9.0	4-16	High-------	0.32			
	14-60	---	---	---	---	---	---	-----------	----			
Badland.												

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
OeE*:												
Orella----------	0-3	40-50	1.00-1.20	0.06-0.2	0.09-0.11	7.4-8.4	<4	High------	0.37	2	4	.5-1
	3-14	38-65	1.00-1.20	<0.06	0.09-0.11	7.4-9.0	4-16	High------	0.32			
	14-60	---	---	---	---	---	---	----------	----			
Interior--------	0-2	15-26	1.15-1.25	0.6-2.0	0.16-0.19	7.4-9.0	<2	Low-------	0.32	5	4L	<1
	2-60	20-35	1.25-1.40	0.2-2.0	0.14-0.17	7.9-9.0	<4	Low-------	0.43			
Badland.												
OtA, OtB--------- Ottumwa	0-7	40-60	1.15-1.30	0.06-0.2	0.10-0.14	6.6-8.4	<2	High------	0.37	5	4	2-4
	7-25	45-60	1.25-1.40	0.06-0.2	0.11-0.16	7.4-9.0	<2	High------	0.37			
	25-51	45-60	1.25-1.40	0.06-0.2	0.11-0.16	6.6-8.4	<2	High------	0.37			
	51-60	---	---	---	---	---	---	----------	----			
OvC*:												
Ottumwa---------	0-7	40-60	1.15-1.30	0.06-0.2	0.10-0.14	6.6-8.4	<2	High------	0.37	5	4	2-4
	7-25	45-60	1.25-1.40	0.06-0.2	0.11-0.16	7.4-9.0	<2	High------	0.37			
	25-51	45-60	1.25-1.40	0.06-0.2	0.11-0.16	6.6-8.4	<2	High------	0.37			
	51-60	---	---	---	---	---	---	----------	----			
Razor-----------	0-4	40-50	1.15-1.30	0.06-0.2	0.13-0.18	6.6-8.4	<2	High------	0.32	4	4L	1-3
	4-15	35-60	1.20-1.40	0.06-0.2	0.12-0.17	7.4-8.4	<2	High------	0.37			
	15-30	35-60	1.20-1.40	0.06-0.2	0.12-0.17	7.4-8.4	<2	High------	0.37			
	30-60	---	---	---	---	---	---	----------	----			
Ow--------------- Owanka	0-6	33-40	1.15-1.25	0.2-2.0	0.16-0.19	6.1-7.8	<2	High------	0.32	5	4	2-4
	6-18	35-45	1.20-1.40	0.2-0.6	0.12-0.16	6.1-7.8	<2	High------	0.28			
	18-35	35-45	1.20-1.40	0.2-0.6	0.12-0.16	7.4-8.4	<2	High------	0.37			
	35-60	30-50	1.20-1.40	0.2-0.6	0.11-0.15	7.4-8.4	<2	High------	0.37			
Ox*:												
Owanka----------	0-6	33-40	1.15-1.25	0.2-2.0	0.16-0.19	6.1-7.8	<2	High------	0.32	5	4	2-4
	6-18	35-45	1.20-1.40	0.2-0.6	0.12-0.16	6.1-7.8	<2	High------	0.28			
	18-35	35-45	1.20-1.40	0.2-0.6	0.12-0.16	7.4-8.4	<2	High------	0.37			
	35-60	30-50	1.20-1.40	0.2-0.6	0.11-0.15	7.4-8.4	<2	High------	0.37			
Beckton---------	0-4	25-40	1.30-1.40	0.2-0.6	0.10-0.13	6.1-8.4	<8	Moderate--	0.37	3	6	1-3
	4-6	10-20	1.40-1.45	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low-------	0.20			
	6-18	35-50	1.40-1.50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High------	0.28			
	18-28	35-50	1.40-1.50	<0.2	0.09-0.12	7.4-9.0	>4	High------	0.28			
	28-60	35-50	1.30-1.45	<0.2	0.10-0.13	>7.4	>4	High------	0.28			
PdF*:												
Penrose---------	0-4	15-27	1.35-1.45	0.6-2.0	0.15-0.18	7.9-8.4	<2	Low-------	0.32	1	4L	.5-1
	4-15	15-30	1.35-1.45	0.6-2.0	0.15-0.18	7.9-8.4	<2	Low-------	0.24			
	15-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
PeB, PeC, PeD---- Pierre	0-5	50-70	1.10-1.25	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	5-19	60-70	1.10-1.25	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	19-31	60-70	1.10-1.35	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	31-60	---	---	---	---	---	---	----------	----			
PgD*:												
Pierre----------	0-5	50-70	1.10-1.25	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	5-19	60-70	1.10-1.25	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	19-31	60-70	1.10-1.25	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	31-60	---	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
PgD*:												
Grummit----------	0-3	40-65	1.15-1.30	0.2-0.6	0.08-0.17	3.6-5.5	<2	High------	0.37	2	4	1-2
	3-12	40-65	1.10-1.25	0.6-2.0	0.08-0.17	3.6-5.5	<2	High------	0.28			
	12-60	---	---	---	---	---	---	----------	----			
PhB*:												
Pierre----------	0-5	50-70	1.10-1.25	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	5-19	60-70	1.10-1.25	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	19-31	60-70	1.10-1.25	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	31-60	---	---	---	---	---	---	----------	----			
Hisle-----------	0-2	18-27	1.10-1.25	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low-------	0.28	3	6	1-3
	2-28	50-60	1.25-1.40	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	28-60	---	---	---	---	---	---	----------	----			
PkC*:												
Pierre----------	0-5	50-70	1.10-1.25	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	5-19	60-70	1.10-1.25	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	19-31	60-70	1.10-1.25	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	31-60	---	---	---	---	---	---	----------	----			
Urban land.												
Ps*. Pits												
RaB, RaC--------- Razor	0-4	40-50	1.15-1.30	0.06-0.2	0.13-0.18	6.6-8.4	<2	High------	0.32	4	4	1-3
	4-15	35-60	1.20-1.40	0.06-0.2	0.12-0.17	7.4-8.4	<2	High------	0.37			
	15-30	35-60	1.20-1.40	0.06-0.2	0.12-0.17	7.4-8.4	<2	High------	0.37			
	30-60	---	---	---	---	---	---	----------	----			
RbD*:												
Razor-----------	0-4	40-50	1.15-1.30	0.06-0.2	0.13-0.18	6.6-8.4	<2	High------	0.32	4	4	1-3
	4-15	35-60	1.20-1.40	0.06-0.2	0.12-0.17	7.4-8.4	<2	High------	0.37			
	15-30	35-60	1.20-1.40	0.06-0.2	0.12-0.17	7.4-8.4	<2	High------	0.37			
	30-60	---	---	---	---	---	---	----------	----			
Midway----------	0-4	30-40	1.25-1.35	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.32	2	4L	.5-2
	4-16	35-45	1.20-1.35	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High------	0.43			
	16-60	---	---	---	---	---	---	----------	----			
Rv*. Riverwash												
SbF-------------- Samsil	0-2	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	2-17	50-65	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	17-60	---	---	---	---	---	---	----------	----			
ScE*:												
Samsil----------	0-2	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	2-17	50-65	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	17-60	---	---	---	---	---	---	----------	----			
Pierre----------	0-5	50-70	1.10-1.25	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	5-19	60-70	1.10-1.25	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	19-31	60-70	1.10-1.25	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	31-60	---	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
SdF*:												
Samsil----------	0-2	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	2-17	50-65	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	17-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
SeA, SeB, SeC---- Satanta	0-11	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low--------	0.28	5	6	1-3
	11-22	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	22-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			
SgA*:												
Satanta---------	0-11	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low--------	0.28	5	6	1-3
	11-22	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	22-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			
Beckton---------	0-4	20-40	1.30-1.40	0.2-0.6	0.10-0.13	6.1-8.4	<8	Moderate	0.37	3	6	1-3
	4-6	10-20	1.40-1.45	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low--------	0.20			
	6-18	35-50	1.40-1.50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High-------	0.28			
	18-28	35-50	1.40-1.50	<0.2	0.09-0.12	7.4-9.0	>4	High-------	0.28			
	28-60	35-50	1.30-1.45	<0.2	0.10-0.13	>7.4	>4	High-------	0.28			
SkA*, SkB*:												
Satanta---------	0-11	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low--------	0.28	5	6	1-3
	11-22	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	22-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			
Urban land.												
SmA, SmB, SmC---- Savo	0-4	20-26	1.10-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	6	2-4
	4-14	35-50	1.20-1.40	0.2-0.6	0.11-0.19	6.1-7.8	<2	High-------	0.43			
	14-42	25-35	1.20-1.40	0.2-0.6	0.11-0.19	7.4-8.4	<2	High-------	0.43			
	42-60	20-35	1.25-1.45	0.2-2.0	0.11-0.17	7.4-8.4	<2	Moderate	0.43			
SoB*:												
Savo------------	0-4	20-26	1.10-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	6	2-4
	4-14	35-50	1.20-1.40	0.2-0.6	0.11-0.19	6.1-7.8	<2	High-------	0.43			
	14-42	25-35	1.20-1.40	0.2-0.6	0.11-0.19	7.4-8.4	<2	High-------	0.43			
	42-60	20-35	1.25-1.45	0.2-2.0	0.11-0.17	7.4-8.4	<2	Moderate	0.43			
Urban land.												
StE*:												
Schamber--------	0-4	18-25	1.40-1.60	>6.0	0.03-0.06	6.1-8.4	<2	Low--------	0.20	2	8	.5-2
	4-60	2-10	1.40-1.65	>6.0	0.03-0.06	7.4-8.4	<2	Low--------	0.10			
Samsil----------	0-2	45-60	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	2-17	50-65	1.15-1.30	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	17-60	---	---	---	---	---	---	----------	----			
SuE-------------- Shingle	0-3	18-27	1.20-1.25	0.6-2.0	0.16-0.18	7.4-9.0	<2	Low--------	0.28	2	4L	1-3
	3-14	20-35	1.30-1.40	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate	0.49			
	14-60	---	---	---	---	---	---	----------	----			
SvF*:												
Shingle---------	0-3	18-27	1.20-1.25	0.6-2.0	0.16-0.18	7.4-9.0	<2	Low--------	0.28	2	4L	1-3
	3-14	20-35	1.30-1.40	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate	0.49			
	14-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
SzB-------------- Swanboy	0-5	55-70	1.05-1.15	<0.06	0.08-0.12	6.6-9.0	<2	Very high	0.37	5	4	1-2
	5-60	60-70	1.10-1.30	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
TfA-------------- Tilford	0-7	15-27	1.15-1.30	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low--------	0.32	5	6	2-4
	7-29	18-30	1.25-1.40	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low--------	0.43			
	29-60	18-30	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.43			
VbD-------------- Valent	0-4	3-10	1.50-1.60	6.0-20	0.07-0.12	6.6-7.8	<2	Low--------	0.17	5	2	.5-1
	4-60	2-8	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.10			
VbwB*:												
Valent----------	0-4	3-10	1.50-1.60	6.0-20	0.07-0.12	6.6-7.8	<2	Low--------	0.17	5	2	.5-1
	4-60	2-8	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.10			
Wortman---------	0-13	0-10	1.40-1.70	6.0-20	0.07-0.12	5.6-7.3	<2	Low--------	0.10	3	2	1-3
	13-22	35-50	1.10-1.30	<0.06	0.11-0.16	6.1-7.8	<2	High------	0.32			
	22-31	30-50	1.15-1.35	0.06-0.6	0.11-0.20	7.4-9.0	<4	High------	0.32			
	31-60	---	---	---	---	---	---	----------	----			
WaA-------------- Wanblee	0-3	15-25	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Low--------	0.32	3	6	2-5
	3-8	35-45	1.05-1.25	<0.06	0.10-0.16	6.6-7.8	2-16	High------	0.32			
	8-29	15-30	1.15-1.30	0.2-0.6	0.13-0.17	7.9-9.0	4-16	Moderate	0.32			
	29-60	---	---	---	---	---	---	----------	----			
WbB*:												
Wanblee---------	0-3	15-25	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Low--------	0.32	3	6	2-5
	3-8	35-45	1.05-1.25	<0.06	0.10-0.16	6.6-7.8	2-16	High------	0.32			
	8-29	15-30	1.15-1.30	0.2-0.6	0.13-0.17	7.9-9.0	4-16	Moderate	0.32			
	29-60	---	---	---	---	---	---	----------	----			
Wortman---------	0-5	10-20	1.15-1.30	0.6-2.0	0.18-0.22	6.1-7.8	<2	Low--------	0.37	3	5	2-4
	5-17	35-50	1.05-1.15	<0.06	0.08-0.14	6.6-8.4	4-16	High------	0.32			
	17-34	15-26	1.20-1.30	0.2-0.6	0.13-0.15	7.4-9.0	2-16	Moderate	0.32			
	34-60	---	---	---	---	---	---	----------	----			
WeA-------------- Weta	0-3	15-25	1.25-1.45	0.6-2.0	0.16-0.19	5.1-7.8	<2	Low--------	0.37	2	6	1-3
	3-12	35-50	1.20-1.40	<0.2	0.10-0.16	6.6-8.4	<4	High------	0.32			
	12-21	30-45	1.20-1.40	0.06-0.6	0.08-0.14	7.4-9.0	2-8	Moderate	0.32			
	21-60	25-34	1.25-1.40	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate	0.43			
Wh--------------- Whitelake	0-7	5-15	1.25-1.40	0.6-2.0	0.11-0.17	5.6-7.8	<2	Low--------	0.24	3	3	1-3
	7-10	5-15	1.25-1.40	0.6-6.0	0.09-0.15	5.6-7.8	<2	Low--------	0.24			
	10-27	18-35	1.35-1.55	0.06-0.2	0.10-0.15	>7.3	4-16	Low--------	0.32			
	27-60	10-25	1.30-1.55	0.6-6.0	0.06-0.17	>7.3	2-8	Low--------	0.32			
WkA-------------- Whitewater	0-3	55-65	1.00-1.15	<0.06	0.05-0.08	7.4-9.0	<2	Very high	0.37	4	4	1-2
	3-16	60-70	1.00-1.15	<0.06	0.05-0.08	7.4-9.0	<2	Very high	0.37			
	16-26	60-70	1.00-1.15	<0.06	0.05-0.08	7.4-9.0	2-4	Very high	0.37			
	26-33	50-65	1.15-1.25	<0.06	0.05-0.11	7.4-9.0	4-8	Very high	0.37			
	33-60	---	---	---	---	---	---	----------	----			
WoB*:												
Whitewater------	0-3	55-65	1.00-1.15	<0.06	0.05-0.08	7.4-9.0	<2	Very high	0.37	4	4	1-2
	3-16	60-70	1.00-1.15	<0.06	0.05-0.08	7.4-9.0	<2	Very high	0.37			
	16-26	60-70	1.00-1.15	<0.06	0.05-0.08	7.4-9.0	2-4	Very high	0.37			
	26-33	50-65	1.15-1.25	<0.06	0.05-0.11	7.4-9.0	4-8	Very high	0.37			
	33-60	---	---	---	---	---	---	----------	----			
Orella----------	0-3	40-50	1.00-1.20	0.06-0.2	0.09-0.11	7.4-8.4	<4	High------	0.32	2	4	5-1
	3-14	38-65	1.00-1.20	<0.06	0.09-0.11	7.4-9.0	4-16	High------	0.32			
	14-60	---	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
WwB-------------- Wortman	0-5	10-20	1.15-1.30	0.6-2.0	0.18-0.22	6.1-7.8	<2	Low--------	0.37	3	5	2-4
	5-17	35-50	1.05-1.15	<0.06	0.08-0.14	6.6-8.4	4-16	High-------	0.32			
	17-34	15-26	1.20-1.30	0.2-0.6	0.13-0.15	7.4-9.0	2-16	Moderate	0.32			
	34-60	---	---	---	---	---	---	----------	----			
ZnD*:												
Zigweid---------	0-10	18-27	1.15-1.25	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	0.28	5	6	1-2
	10-60	18-35	1.25-1.40	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate	0.43			
Nihill----------	0-5	10-27	1.15-1.25	0.6-2.0	0.12-0.16	6.6-8.4	<2	Low--------	0.20	2	8	.5-1
	5-60	18-30	1.30-1.40	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low--------	0.05			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AaA, AaB, AaC----- Altvan	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
ArA--------------- Arvada	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
BaA--------------- Baca	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Bb*. Badland												
BcB--------------- Bankard	A	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
BfA--------------- Beckton	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
BhA*:												
Beckton-----------	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Arvada------------	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
BkA, BkB, BlA, BlB--------------- Blackpipe	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
BnC*:												
Blackpipe---------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
Norrest-----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
BoA*, BoB*:												
Blackpipe---------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
BoA*, BoB*:												
Wortman-----------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Bp------------------ Bridgeport	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Ca------------------ Cactusflat	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Cb*:												
Cactusflat-------	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Weta-------------	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
CeA----------------- Cedarpass	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
CfA*:												
Cedarpass--------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Denby------------	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Ch*:												
Cedarpass--------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Interior---------	B	Frequent----	Brief-----	Mar-Oct	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Badland.												
ClF----------------- Colby	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
CmC*:												
Colby------------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Norka------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Cn------------------ Colombo	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Co------------------ Colombo	B	Occasional	Brief-----	Mar-Jun	>6.0	---	---	>60	---	Moderate	High-----	Low.
Cp*:												
Colombo----------	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
Cp*:												
Urban land.												
CuD*:												
Conata-----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Low.
Hisle------------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
CyC--------------- Cushman	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
CzD*:												
Cushman----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
Shingle----------	D	None--------	---	---	>6.0	---	---	4-20	Soft	Low------	High-----	Low.
DmA--------------- Denby	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Eg---------------- Egas	D	Occasional	Brief-----	Apr-Oct	0-1.0	Apparent	Oct-Jun	>60	---	High-----	High-----	Moderate.
EmA, EmB---------- Emigrant	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
EnD*:												
Enning-----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate	Moderate.
Minnequa---------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
FaE, FgE---------- Fairburn	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate	Low.
FhE*:												
Fairburn---------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate	Low.
Badland.												
FoF*:												
Fairburn---------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate	Low.
Orella-----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
FoF*:												
Badland.												
Gb---------------- Glenberg	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
GrE*:												
Grummit----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	High.
Rock outcrop.												
GsD*:												
Grummit----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	High.
Urban land.												
Ha---------------- Haverson	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Hc---------------- Haverson	B	Occasional	Brief-----	May-Sep	>6.0	---	---	>60	---	Low------	High-----	Low.
HpB--------------- Hisle	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
HrC*:												
Hisle------------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Rock outcrop.												
HsB*:												
Hisle------------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Slickspots.												
Hv---------------- Hoven	D	None--------	---	---	+1-1.5	Perched	Mar-Jul	40-60	Soft	Moderate	High-----	Moderate.
Hz---------------- Hoven Variant	D	None--------	---	---	+2-4.0	Apparent	Jan-Dec	40-60	Soft	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
In----------------- Interior	B	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Io----------------- Interior	B	Frequent-----	Brief------	Mar-Oct	>6.0	---	---	>60	---	Low-------	High------	Moderate.
IrB*:												
Interior----------	B	Frequent-----	Brief------	Mar-Oct	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Cedarpass---------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Denby-------------	C	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
JaA, JaC---------- Jayem	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
KtA, KyA, KyB, KyC--------------- Kyle	D	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
LaB, LaD---------- Larvie	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Low.
LhC*:												
Larvie------------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Low.
Hisle-------------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
Lo----------------- Lohmiller	C	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Lp----------------- Lohmiller	C	Occasional	Brief------	Mar-Sep	>6.0	---	---	>60	---	Low-------	High------	Moderate.
MaB---------------- Manvel	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
MeC*:												
Manvel------------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
Minnequa----------	C	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
MgC*:												
Manvel	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Urban land.												
MoE Midway	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
MosE Midway	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
MpD*:												
Midway	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Urban land.												
MrC*:												
Minnequa	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Penrose	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
NdE, NeD Nihill	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
NgA, NgB Norka	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
NhA*:												
Norka	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Weta	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
NkD Norrest	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
NuA, NuB, NuC Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
NvA*, NvC*:												
Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Beckton	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
NwA*:												
Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Urban land.												
ObE*:												
Orella	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
Badland.												
OeE*:												
Orella	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
Interior	B	Frequent	Brief	Mar-Oct	>6.0	---	---	>60	---	Low	High	Moderate.
Badland.												
OtA, OtB Ottumwa	D	None	---	---	>6.0	---	---	40-60	Soft	Low	High	Low.
OvC*:												
Ottumwa	D	None	---	---	>6.0	---	---	40-60	Soft	Low	High	Low.
Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Ow Owanka	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Ox*:												
Owanka	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Beckton	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
PdF*:												
Penrose	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
Rock outcrop.												
PeB, PeC, PeD Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
PgD*:												
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Grummit	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	High.
PhB*:												
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
PkC*:												
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Urban land.												
Ps*. Pits												
RaB, RaC Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
RbD*:												
Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Midway	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Rv*. Riverwash												
SbF Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
ScE*:												
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
SdF*:												
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Rock outcrop.												

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
SeA, SeB, SeC: Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
SgA*:												
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Beckton	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
SkA*, SkB*:												
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Urban land.												
SmA, SmB, SmC: Savo	C	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
SoB*:												
Savo	C	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Urban land.												
StE*:												
Schamber	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
SuE: Shingle	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Low.
SvF*:												
Shingle	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Low.
Rock outcrop.												
SzB: Swanboy	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
TfA: Tilford	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
VbD: Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
VbwB*:												
Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Wortman	A	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
WaA Wanblee	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
WbB*:												
Wanblee	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Wortman	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
WeA Weta	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Wh Whitelake	B	None	---	---	2.0-4.0	Perched	Apr-Jul	>60	---	High	High	Moderate.
WkA Whitewater	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
WoB*:												
Whitewater	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Orella	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
WwB Wortman	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
ZnD*:												
Zigweid	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Nihill	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Arvada	Fine, montmorillonitic, mesic Ustollic Natrargids
Baca	Fine, montmorillonitic, mesic Ustollic Haplargids
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Beckton	Fine, montmorillonitic, mesic Aridic Natrustolls
Blackpipe	Fine, montmorillonitic, mesic Aridic Argiustolls
Bridgeport	Fine-silty, mixed, mesic Fluventic Haplustolls
Cactusflat	Fine, montmorillonitic, mesic Torrertic Haplustolls
Cedarpass	Fine-silty, mixed, mesic Ustollic Camborthids
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Colombo	Fine-loamy, mixed, mesic Torrifluventic Haplustolls
Conata	Clayey, montmorillonitic, mesic, shallow Ustollic Camborthids
Cushman	Fine-loamy, mixed, mesic Ustollic Haplargids
Denby	Fine, montmorillonitic, mesic Ustertic Camborthids
Egas	Fine, montmorillonitic (calcareous), mesic Typic Haplaquolls
Emigrant	Fine, montmorillonitic, mesic Aridic Argiustolls
Enning	Loamy, carbonatic, mesic, shallow Ustic Torriorthents
Fairburn	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Grummit	Clayey, montmorillonitic, acid, mesic, shallow Ustic Torriorthents
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Hisle	Fine, montmorillonitic, mesic Ustollic Natrargids
*Hoven	Fine, montmorillonitic, mesic Typic Natraquolls
Hoven Variant	Fine, montmorillonitic, mesic Vertic Haplaquolls
Interior	Fine-silty, mixed (calcareous), mesic Ustic Torrifluvents
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
*Kyle	Very fine, montmorillonitic, mesic Typic Torrerts
Larvie	Very fine, montmorillonitic, mesic Typic Torrerts
Lohmiller	Fine, montmorillonitic (calcareous), mesic Ustic Torrifluvents
Manvel	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Minnequa	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Nihill	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Norka	Fine-silty, mixed, mesic Aridic Argiustolls
Norrest	Fine, montmorillonitic, mesic Ustollic Haplargids
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Orella	Clayey, mixed (calcareous), mesic, shallow Ustic Torriorthents
Ottumwa	Fine, montmorillonitic, mesic Vertic Haplustolls
Owanka	Fine, montmorillonitic, mesic Aridic Haplustolls
Penrose	Loamy, carbonatic, mesic Lithic Ustic Torriorthents
Pierre	Fine, montmorillonitic, mesic Typic Torrerts
Razor	Fine, montmorillonitic, mesic Ustollic Camborthids
Samsil	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Savo	Fine, montmorillonitic, mesic Aridic Argiustolls
Schamber	Sandy-skeletal, mixed, mesic Ustic Torriorthents
Shingle	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Swanboy	Very fine, montmorillonitic, mesic Typic Torrerts
Tilford	Fine-silty, mixed, mesic Torriorthentic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments
Wanblee	Fine, montmorillonitic, mesic Ustollic Natrargids
Weta	Fine, montmorillonitic, mesic Leptic Natrustolls
Whitelake	Fine-loamy, mixed, mesic Typic Natrustolls
Whitewater	Very fine, montmorillonitic, mesic Typic Torrerts
Wortman	Fine, montmorillonitic, mesic Aridic Natrustolls
*Zigweid	Fine-loamy, mixed, mesic Ustollic Camborthids

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil is not assigned to the interpretive group)

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture group
AaA----------------- Altvan	IVs-1	Silty---------------	6G	D1
AaB----------------- Altvan	IVe-2	Silty---------------	6G	D1
AaC----------------- Altvan	VIe-2	Silty---------------	6G	D1
ArA----------------- Arvada	VIs-3	Thin Claypan--------	10	NS
BaA----------------- Baca	IIIe-1	Silty---------------	3	F
Bb------------------ Badland	VIIIs-2	--------------------	10	NS
BcB----------------- Bankard	IVe-6	Sands---------------	7	H
BfA----------------- Beckton	IVs-2	Claypan-------------	9	C
BhA:				
Beckton------------	IVs-2	Claypan-------------	9	C
Arvada-------------	VIs-3	Thin Claypan--------	10	NS
BkA----------------- Blackpipe	IIIc-1	Silty---------------	6R	F
BkB----------------- Blackpipe	IIIe-1	Silty---------------	6R	F
BlA----------------- Blackpipe	IIIc-1	Silty---------------	6R	F
BlB----------------- Blackpipe	IIIe-1	Silty---------------	6R	F
BnC:				
Blackpipe----------	IVe-1	Silty---------------	6R	F
Norrest------------	VIe-3	Clayey--------------	6R	F
BoA:				
Blackpipe----------	IIIc-1	Silty---------------	6R	F
Wortman------------	IVs-2	Claypan-------------	9	C
BoB:				
Blackpipe----------	IIIe-1	Silty---------------	6R	F
Wortman------------	IVs-2	Claypan-------------	9	C
Bp------------------ Bridgeport	IIIc-1	Loamy Terrace-------	1	K
Ca------------------ Cactusflat	IIIs-1	Clayey--------------	4C	I

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture group
Cb:				
Cactusflat--------	IIIs-1	Clayey------------	4C	I
Weta--------------	VIs-3	Thin Claypan-------	10	NS
CeA----------------	IVe-10	Silty-------------	8	F
Cedarpass				
CfA:				
Cedarpass---------	IVe-10	Silty-------------	8	F
Denby-------------	IVs-6	Clayey------------	4C	I
Ch:				
Cedarpass---------	IVe-10	Silty-------------	8	F
Interior----------	VIs-7	Badland Overflow---	10	NS
Badland-----------	VIIIs-2	------------------	10	NS
ClF----------------	VIIe-1	Thin Upland--------	10	NS
Colby				
CmC:				
Colby-------------	VIe-3	Thin Upland--------	8	G
Norka-------------	IVe-1	Silty-------------	3	F
Cn-----------------	IIIc-2	Loamy Terrace------	1	F
Colombo				
Co-----------------	VIw-1	Loamy Overflow-----	1	NS
Colombo				
CuD:				
Conata------------	VIe-12	Shallow Clay-------	10	NS
Hisle-------------	VIs-3	Thin Claypan-------	10	NS
CyC----------------	IVe-1	Silty-------------	6R	F
Cushman				
CzD:				
Cushman-----------	VIe-1	Silty-------------	6R	F
Shingle-----------	VIe-11	Shallow------------	10	NS
DmA----------------	IVs-6	Clayey------------	4C	I
Denby				
Eg-----------------	VIs-6	Saline Lowland-----	10	J
Egas				
EmA----------------	IIIc-1	Silty-------------	6R	F
Emigrant				
EmB----------------	IIIe-1	Silty-------------	6R	F
Emigrant				
EnD:				
Enning------------	VIe-11	Shallow------------	10	NS
Minnequa----------	VIe-3	Thin Upland--------	10	NS
FaE----------------	VIe-11	Thin Upland--------	10	NS
Fairburn				
FgE----------------	VIIs-6	Thin Upland--------	10	NS
Fairburn				

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture group
FhE:				
Fairburn	VIe-11	Thin Upland	10	NS
Badland	VIIIs-1	---	10	NS
FoF:				
Fairburn	VIIe-5	Thin Upland	10	NS
Orella	VIIe-5	Shallow Clay	10	NS
Badland	VIIIs-1	---	10	NS
Gb Glenburg	IVe-6	Loamy Overflow	1	H
GrE:				
Grummit	VIIe-5	Shallow Clay	10	NS
Rock outcrop	VIIIs-2	---	10	NS
Ha Haverson	IIIc-2	Loamy Terrace	1	F
Hc Haverson	VIw-1	Loamy Overflow	1	NS
HpB Hisle	VIs-3	Thin Claypan	10	NS
HrC:				
Hisle	VIs-3	Thin Claypan	10	NS
Rock outcrop	VIIIs-2	---	10	NS
HsB:				
Hisle	VIs-3	Thin Claypan	10	NS
Slickspots	VIIIs-3	---	10	NS
Hv Hoven	VIs-3	Closed Depression	10	B2
Hz Hoven Variant	VIIIw-1	---	10	NS
In Interior	VIs-7	Thin Upland	10	NS
Io Interior	VIw-1	Badland Overflow	10	NS
IrB:				
Interior	VIs-7	Badland Overflow	10	NS
Cedarpass	IVe-10	Silty	8	F
Denby	IVs-6	Clayey	4C	I
JaA Jayem	IIIe-4	Sandy	5	H
JaC Jayem	IVe-6	Sandy	5	H
KtA Kyle	IVs-3	Clayey	4C	I
KyA Kyle	IVs-3	Clayey	4C	I

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture group
KyB: Kyle	IVe-3	Clayey	4C	I
KyC: Kyle	IVe-14	Clayey	4C	I
LaB: Larvie	IVs-3	Clayey	4C	I
LaD: Larvie	VIe-4	Clayey	10	I
LhC:				
Larvie	IVe-14	Clayey	4C	I
Hisle	VIs-3	Thin Claypan	10	NS
Lo: Lohmiller	IIIc-2	Loamy Terrace	1	F
Lp: Lohmiller	VIw-1	Loamy Overflow	1	NS
MaB: Manvel	IVe-10	Thin Upland	8	G
MeC:				
Manvel	IVe-10	Thin Upland	8	G
Minnequa	VIe-3	Thin Upland	8	G
MoE: Midway	VIIe-5	Shallow Clay	10	NS
MosE: Midway	VIIs-6	Shallow Clay	10	NS
MrC:				
Minnequa	VIe-3	Thin Upland	8	G
Penrose	VIs-1	Shallow	10	NS
NdE: Nihill	VIs-4	Very Shallow	10	NS
NeD: Nihill	VIIs-6	Very Shallow	10	NS
NgA: Norka	IIIc-1	Silty	3	F
NgB: Norka	IIIe-1	Silty	3	F
NhA:				
Norka	IIIc-1	Silty	3	F
Weta	VIs-3	Thin Claypan	10	NS
NkD: Norrest	VIe-3	Clayey	6R	F
NuA: Nunn	IIIc-1	Silty	3	F

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture group
NuB---------------- Nunn	IIIe-1	Silty--------------	3	F
NuC---------------- Nunn	IVe-1	Silty--------------	3	F
NvA:				
Nunn--------------	IIIc-1	Silty--------------	3	F
Beckton-----------	IVs-2	Claypan------------	9	C
NvC:				
Nunn--------------	IVe-1	Silty--------------	3	F
Beckton-----------	IVs-2	Claypan------------	9	C
ObE:				
Orella------------	VIIe-5	Shallow Clay-------	10	NS
Badland-----------	VIIIs-2	-------------------	10	NS
OeE:				
Orella------------	VIIe-5	Shallow Clay-------	10	NS
Interior----------	VIw-1	Badland Overflow---	10	NS
Badland-----------	VIIIs-1	-------------------	10	NS
OtA---------------- Ottumwa	IIIs-1	Clayey-------------	4C	I
OtB---------------- Ottumwa	IIIe-3	Clayey-------------	4C	I
OvC:				
Ottumwa-----------	IVe-14	Clayey-------------	4C	I
Razor-------------	IVe-14	Clayey-------------	4C	I
Ow----------------- Owanka	IIIc-2	Loamy Terrace------	3	F
Ox:				
Owanka------------	IIIc-2	Loamy Terrace------	3	F
Beckton-----------	IVs-2	Claypan------------	9	C
PdF:				
Penrose-----------	VIIe-1	Shallow------------	10	NS
Rock outcrop------	VIIIs-1	-------------------	10	NS
PeB---------------- Pierre	IVe-3	Clayey-------------	4C	I
PeC---------------- Pierre	IVe-14	Clayey-------------	4C	I
PeD---------------- Pierre	VIe-4	Clayey-------------	4C	I
PgD:				
Pierre------------	VIe-4	Clayey-------------	4C	I
Grummit-----------	VIe-12	Shallow Clay-------	10	NS
PhB:				
Pierre------------	IVe-3	Clayey-------------	4C	I
Hisle-------------	VIs-3	Thin Claypan-------	10	NS

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture group
Ps: Pits	VIIIs-2	---	10	NS
RaB: Razor	IVe-3	Clayey	4C	I
RaC: Razor	IVe-14	Clayey	4C	I
RbD:				
Razor	VIe-4	Clayey	4C	I
Midway	VIe-12	Shallow Clay	10	NS
Rv: Riverwash	VIIIe-2	---	10	NS
SbF: Samsil	VIIe-5	Shallow Clay	10	NS
ScE:				
Samsil	VIe-12	Shallow Clay	10	NS
Pierre	VIe-4	Clayey	10	NS
SdF:				
Samsil	VIIe-5	Shallow Clay	10	NS
Rock outcrop	VIIIs-2	---	10	NS
SeA: Satanta	IIIc-1	Silty	3	F
SeB: Satanta	IIIe-1	Silty	3	F
SeC: Satanta	IVe-1	Silty	3	F
SgA:				
Satanta	IIIc-1	Silty	3	F
Beckton	IVs-2	Claypan	9	C
SmA: Savo	IIIc-1	Silty	3	F
SmB: Savo	IIIe-1	Silty	3	F
SmC: Savo	IVe-1	Silty	3	F
StE:				
Schamber	VIIs-7	Very Shallow	10	NS
Samsil	VIIe-5	Shallow Clay	10	NS
SuE: Shingle	VIIe-4	Shallow	10	NS
SvF:				
Shingle	VIIe-4	Shallow	10	NS
Rock outcrop	VIIIs-2	---	10	NS
SzB: Swanboy	VIs-6	Dense Clay	10	NS

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture group
TfA----------------- Tilford	IIIc-1	Silty--------------	3	F
VbD----------------- Valent	VIe-7	Sands--------------	10	NS
VbwB:				
Valent------------	VIe-7	Sands--------------	10	NS
Wortman-----------	IVs-5	Claypan------------	9	C
WaE----------------- Wanblee	VIs-3	Thin Claypan-------	10	NS
WbB:				
Wanblee-----------	VIs-3	Thin Claypan-------	10	NS
Wortman-----------	IVs-5	Claypan------------	9	C
WeA----------------- Weta	VIs-3	Thin Claypan-------	10	NS
Wh------------------ Whitelake	IVe-12	Sandy--------------	5	H
WkA----------------- Whitewater	VIs-6	Dense Clay---------	10	NS
WoB:				
Whitewater--------	VIe-4	Dense Clay---------	10	NS
Orella------------	VIIe-5	Shallow Clay-------	10	NS
WwB----------------- Wortman	IVs-5	Claypan------------	9	C
ZnD:				
Zigweid-----------	VIe-1	Thin Upland--------	8	G
Nihill------------	IVs-4	Very Shallow-------	10	NS

* Soils in windbreak suitability group 10 are unsuited to windbreaks.

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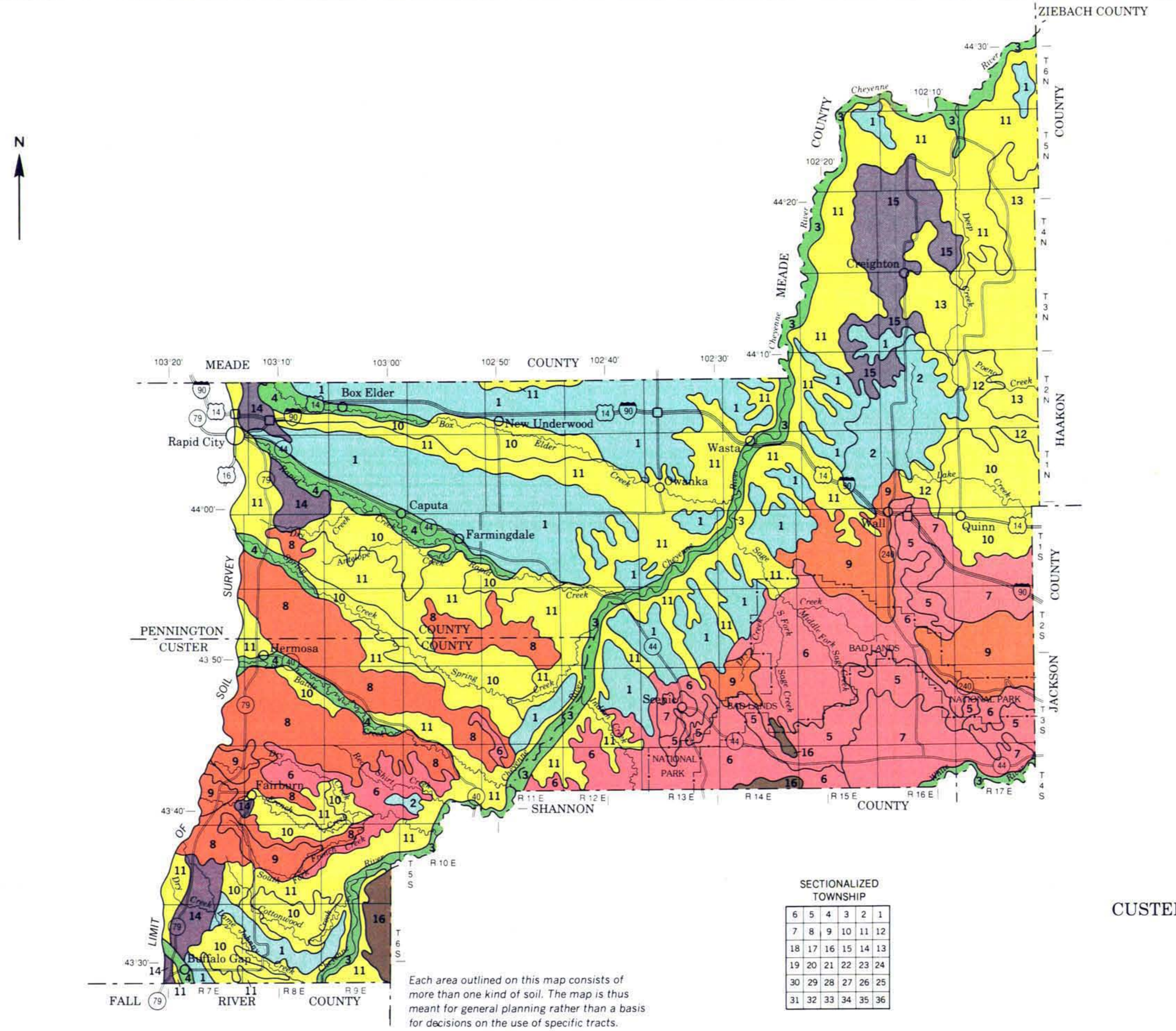


Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

NEARLY LEVEL TO STRONGLY SLOPING, LOAMY AND SILTY SOILS ON PLAINS AND HIGH TERRACES

- 1 Nunn-Satanta association
- 2 Blackpipe-Wortman association

NEARLY LEVEL AND GENTLY UNDULATING, SANDY TO CLAYEY SOILS ON FLOOD PLAINS, TERRACES, AND FANS

- 3 Bankard-Haverson-Lohmiller association
- 4 Owanka-Haverson-Colombo association

AREAS OF NEARLY LEVEL TO STEEP, SILTY, LOAMY, AND CLAYEY SOILS AND AREAS OF BADLAND; ON TERRACES, FANS, FLOOD PLAINS, DISSECTED PLAINS, AND OTHER PLAINS

- 5 Cedarpass-Denby-Interior association
- 6 Orella-Fairburn-Badland association
- 7 Orella-Hisle-Whitewater association

NEARLY LEVEL TO STEEP, LOAMY AND SILTY SOILS ON DISSECTED PLAINS AND OTHER PLAINS

- 8 Norrest-Fairburn-Emigrant association
- 9 Blackpipe-Norrest-Wortman association

NEARLY LEVEL TO VERY STEEP, CLAYEY AND SILTY SOILS ON DISSECTED PLAINS, OTHER PLAINS, AND FANS

- 10 Pierre-Kyle association
- 11 Samsil-Pierre association
- 12 Midway-Razor association
- 13 Ottumwa-Razor association

NEARLY LEVEL TO VERY STEEP, SILTY AND LOAMY SOILS ON DISSECTED PLAINS AND OTHER PLAINS

- 14 Minnequa-Manvel-Penrose association
- 15 Cushman-Shingle association

NEARLY LEVEL TO HILLY, LOAMY AND SANDY SOILS ON DISSECTED PLAINS AND OTHER PLAINS

- 16 Jayem-Valent association

* The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1986

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
FOREST SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

CUSTER AND PENNINGTON COUNTIES, PRAIRIE PARTS, SOUTH DAKOTA

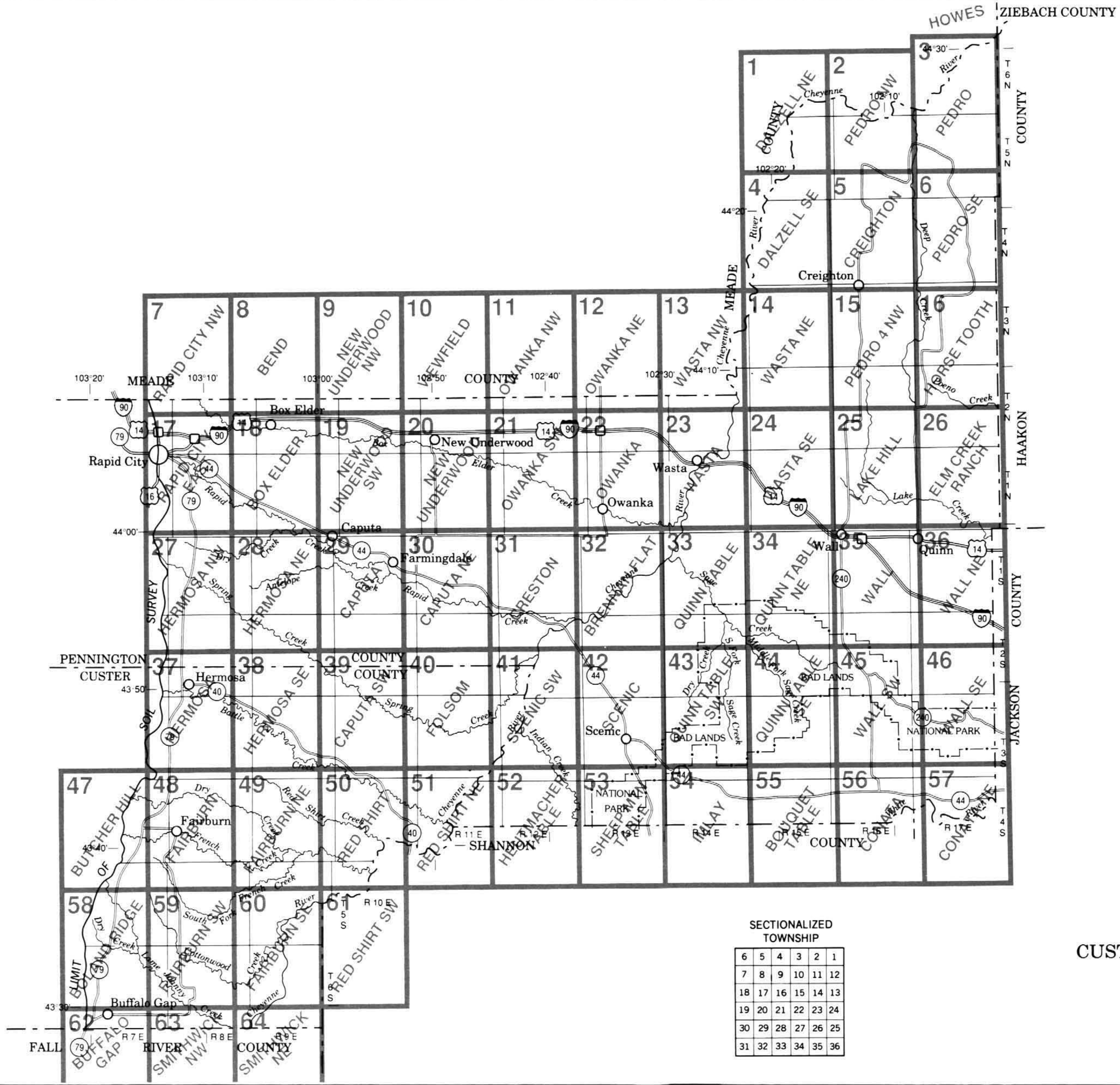
SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Scale 1:506,880

1 0 1 2 3 4 5 6 7 8 Miles

0 8 16 Km



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

CUSTER AND PENNINGTON COUNTIES, PRAIRIE PARTS, SOUTH DAKOTA

Scale 1:506,880

1 0 1 2 3 4 5 6 7 8 Miles

0 8 16 Km

SOIL LEGEND

Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The lowercase letter or letters that follow separate map units having names that begin with the same letter but does not separate slope phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
AaA	Altvan loam, 0 to 2 percent slopes
AaB	Altvan loam, 2 to 6 percent slopes
AaC	Altvan loam, 6 to 9 percent slopes
ArA	Arvada loam, 0 to 4 percent slopes
BaA	Baca silt loam, 0 to 4 percent slopes
Bb	Badland
BcB	Bankard loamy fine sand, 0 to 4 percent slopes
BfA	Beckton silt loam, 0 to 4 percent slopes
BhA	Beckton-Arvada complex, 0 to 4 percent slopes
BkA	Blackpipe silty clay loam, 0 to 2 percent slopes
BkB	Blackpipe silty clay loam, 2 to 6 percent slopes
BlA	Blackpipe clay loam, 0 to 2 percent slopes
BlB	Blackpipe clay loam, 2 to 6 percent slopes
BnC	Blackpipe-Norrest complex, 6 to 12 percent slopes
BoA	Blackpipe-Wortman complex, 0 to 3 percent slopes
BoB	Blackpipe-Wortman complex, 1 to 6 percent slopes
Bp	Bridgeport silt loam
Ca	Cactusflat silty clay
Cb	Cactusflat-Weta complex
CeA	Cedarpass silty clay loam, 0 to 3 percent slopes
CfA	Cedarpass-Denby complex, 0 to 3 percent slopes
Ch	Cedarpass-Interior-Badland complex
ClF	Colby silt loam, 9 to 40 percent slopes
CmC	Colby-Norka silt loams, 6 to 15 percent slopes
Cn	Colombo loam
Co	Colombo loam, channeled
Cp	Colombo-Urban land complex
CuD	Conata-Hisle complex, 6 to 25 percent slopes
CyC	Cushman loam, 6 to 9 percent slopes
CzD	Cushman-Shingle loams, 9 to 15 percent slopes
DmA	Denby silty clay, 0 to 3 percent slopes
Eg	Egas silty clay loam
EmA	Emigrant loam, 0 to 2 percent slopes
EmB	Emigrant loam, 2 to 6 percent slopes
EnD	Enning-Minnequa silt loams, 9 to 25 percent slopes
FaE	Fairburn clay loam, 9 to 40 percent slopes
FgE	Fairburn gravelly clay loam, 15 to 45 percent slopes, bouldery
FhE	Fairburn-Badland complex, 9 to 40 percent slopes
FoF	Fairburn-Orella-Badland complex, 15 to 45 percent slopes
Gb	Glenberg fine sandy loam
GrE	Grummit-Rock outcrop complex, 6 to 40 percent slopes
GsD	Grummit-Urban land complex, 9 to 30 percent slopes
Ha	Haverson silt loam
Hc	Haverson loam, channeled
HpB	Hisle silt loam, 0 to 6 percent slopes
HrC	Hisle-Rock outcrop complex, 2 to 9 percent slopes
HsB	Hisle-Slickspots complex, 0 to 6 percent slopes
Hv	Hoven silt loam
Hz	Hoven Variant silty clay, ponded
In	Interior loam
Io	Interior loam, channeled
IrB	Interior-Cedarpass-Denby complex, 0 to 6 percent slopes
JaA	Jayem fine sandy loam, 0 to 3 percent slopes
JaC	Jayem fine sandy loam, 3 to 9 percent slopes
KtA	Kyle clay, 0 to 1 percent slopes
KyA	Kyle clay, 0 to 3 percent slopes
KyB	Kyle clay, 3 to 6 percent slopes
KyC	Kyle clay, 6 to 9 percent slopes
LaB	Larvie clay, 0 to 4 percent slopes
LaD	Larvie clay, 6 to 15 percent slopes
LhC	Larvie-Hisle complex, 0 to 9 percent slopes
Lo	Lohmiller silty clay
Lp	Lohmiller silty clay, channeled
MaB	Manvel silt loam, 0 to 6 percent slopes
MeC	Manvel-Minnequa silt loams, 2 to 9 percent slopes
MgC	Manvel-Urban land complex, 6 to 15 percent slopes
MoE	Midway silty clay loam, 15 to 40 percent slopes
MosE	Midway clay loam, 15 to 40 percent slopes, stony
MpD	Midway-Urban land complex, 9 to 30 percent slopes
MrC	Minnequa-Penrose complex, 6 to 9 percent slopes
NdE	Nihill gravelly loam, 9 to 40 percent slopes
NeD	Nihill very gravelly loam, 0 to 25 percent slopes
NgA	Norka silt loam, 0 to 2 percent slopes
NgB	Norka silt loam, 2 to 6 percent slopes
NhA	Norka-Weta silt loams, 0 to 3 percent slopes
NkD	Norrest silty clay loam, 6 to 15 percent slopes
NuA	Nunn loam, 0 to 2 percent slopes
NuB	Nunn loam, 2 to 6 percent slopes
NuC	Nunn loam, 6 to 12 percent slopes
NvA	Nunn-Beckton complex, 0 to 3 percent slopes
NvC	Nunn-Beckton complex, 3 to 9 percent slopes
NwA	Nunn-Urban land complex, 0 to 3 percent slopes
ObE	Orella-Badland complex, 9 to 45 percent slopes
OeE	Orella-Interior-Badland complex, 0 to 25 percent slopes
OtA	Ottumwa clay, 0 to 2 percent slopes
OtB	Ottumwa clay, 2 to 6 percent slopes
OvC	Ottumwa-Razor complex, 6 to 9 percent slopes
Ow	Owanka clay loam
Ox	Owanka-Beckton complex
PdF	Penrose-Rock outcrop complex, 9 to 60 percent slopes
PeB	Pierre clay, 2 to 6 percent slopes
PeC	Pierre clay, 6 to 9 percent slopes
PeD	Pierre clay, 6 to 15 percent slopes
PgD	Pierre-Grummit clays, 6 to 15 percent slopes
PhB	Pierre-Hisle complex, 0 to 9 percent slopes
PkC	Pierre-Urban land complex, 6 to 15 percent slopes
Ps	Pits, gravel
RaB	Razor silty clay, 2 to 6 percent slopes
RaC	Razor silty clay, 6 to 9 percent slopes
RbD	Razor-Midway complex, 6 to 15 percent slopes
Rv	Riverwash
SbF	Samsil clay, 25 to 40 percent slopes
ScE	Samsil-Pierre clays, 15 to 25 percent slopes
SdF	Samsil-Rock outcrop complex, 25 to 75 percent slopes
SeA	Satanta loam, 0 to 2 percent slopes
SeB	Satanta loam, 2 to 6 percent slopes
SeC	Satanta loam, 6 to 9 percent slopes
SgA	Satanta-Beckton complex, 0 to 3 percent slopes
SkA	Satanta-Urban land complex, 0 to 2 percent slopes
SkB	Satanta-Urban land complex, 2 to 6 percent slopes
SmA	Savo silt loam, 0 to 2 percent slopes
SmB	Savo silt loam, 2 to 6 percent slopes
SmC	Savo silt loam, 6 to 9 percent slopes
SoB	Savo-Urban land complex, 0 to 9 percent slopes
StE	Schamber-Samsil complex, 15 to 40 percent slopes
SuE	Shingle loam, 15 to 25 percent slopes
SvF	Shingle-Rock outcrop complex, 25 to 60 percent slopes
SzB	Swanboy clay, 0 to 6 percent slopes
TfA	Tilford silt loam, 0 to 2 percent slopes
VbD	Valent loamy fine sand, 6 to 25 percent slopes
VbwB	Valent-Wortman loamy fine sands, 2 to 6 percent slopes
WaA	Wanblee silt loam, 0 to 4 percent slopes
WbB	Wanblee-Wortman silt loams, 0 to 4 percent slopes
WeA	Weta silt loam, 0 to 3 percent slopes
Wh	Whitelake fine sandy loam
WkA	Whitewater clay, 0 to 3 percent slopes
WoB	Whitewater-Orella clays, 3 to 9 percent slopes
WwB	Wortman silt loam, 0 to 6 percent slopes
ZnD	Zigweid-Nihill complex, 6 to 15 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER
(sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE
(normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small
(Named where applicable)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area) (occupied)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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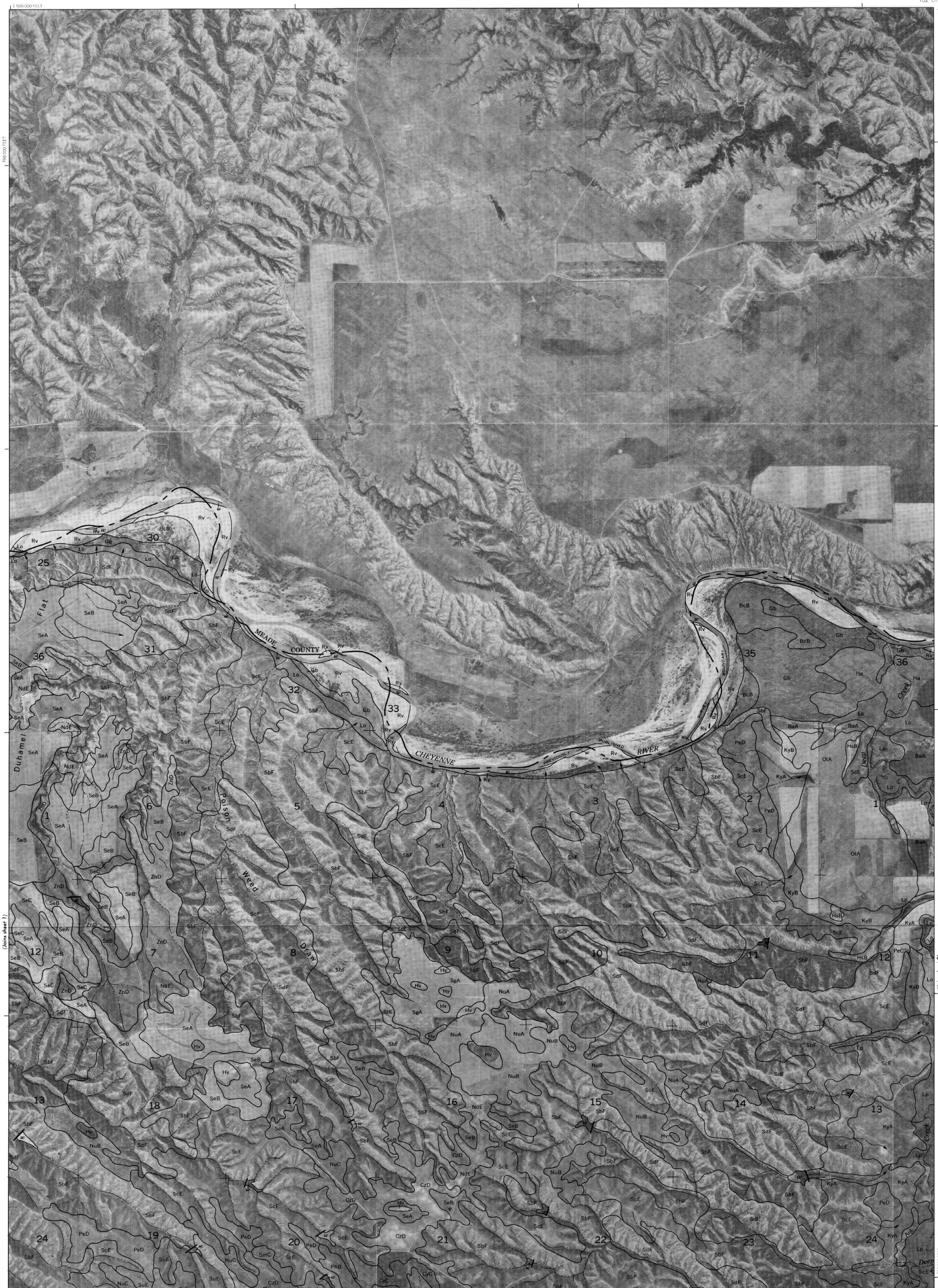
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000



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N

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1 0.5 0 1 2 KILOMETERS
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CUSTER AND PENNINGTON COS., S.D. PRAIRIE PARTS NO. 3

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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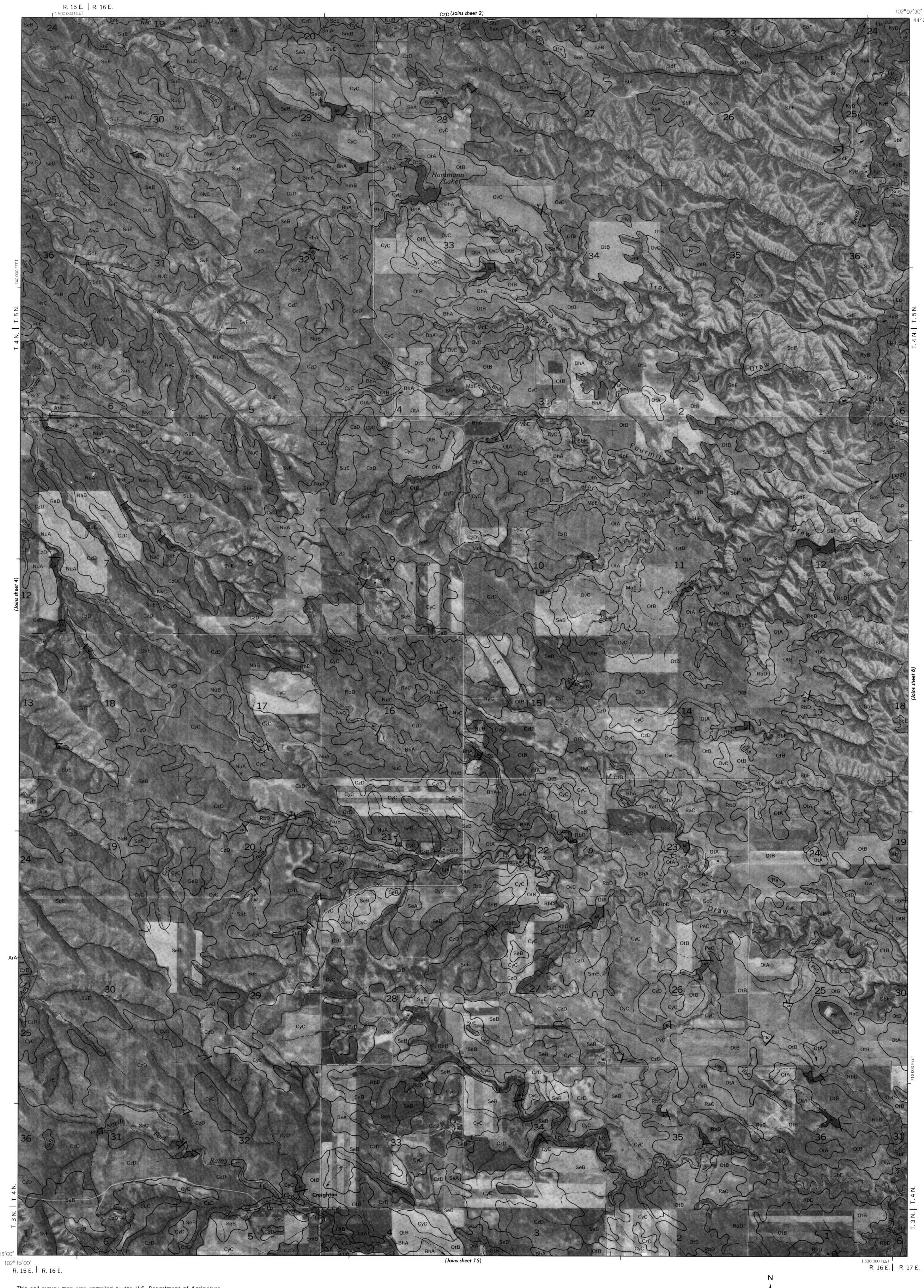
N

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000



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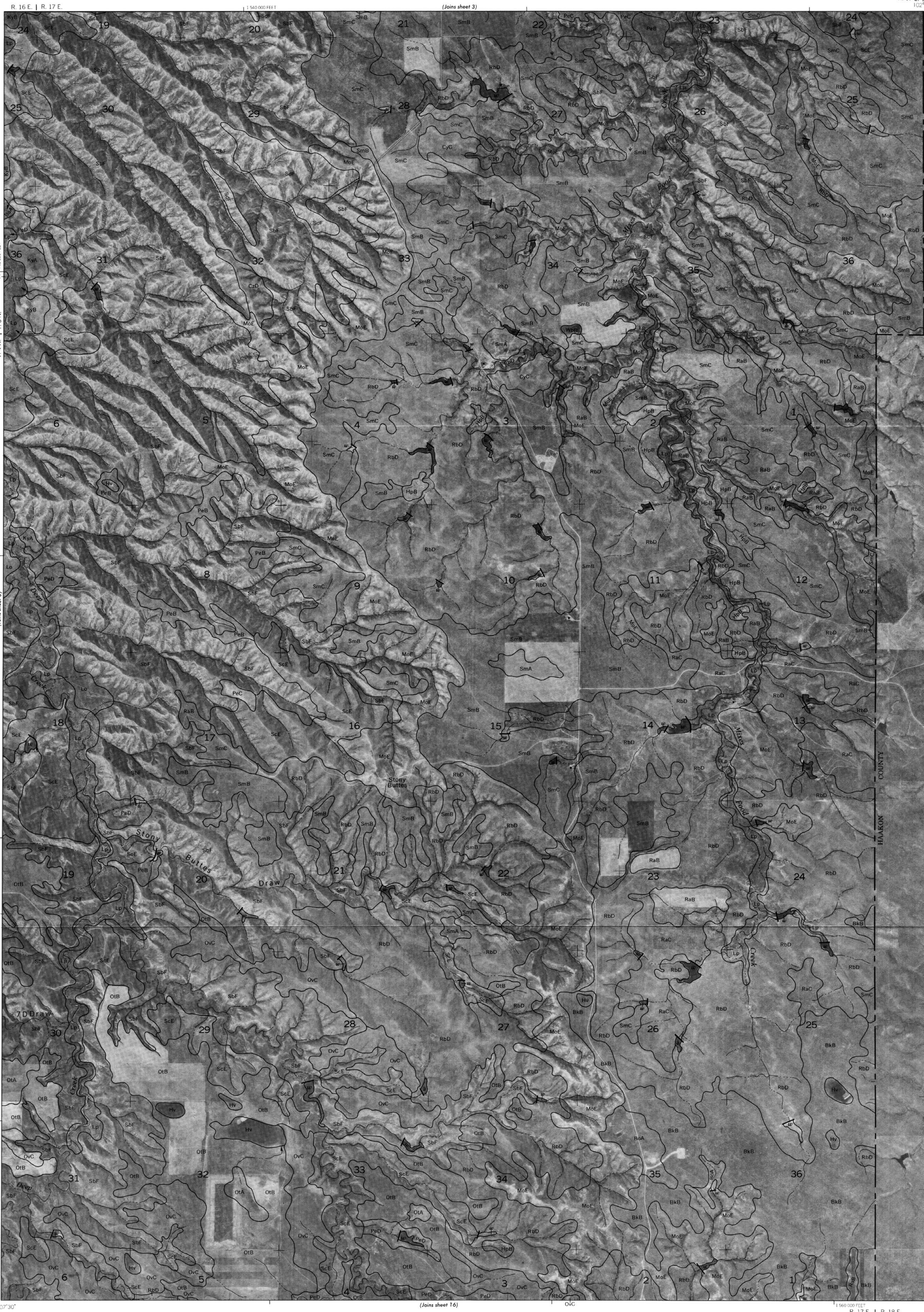
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

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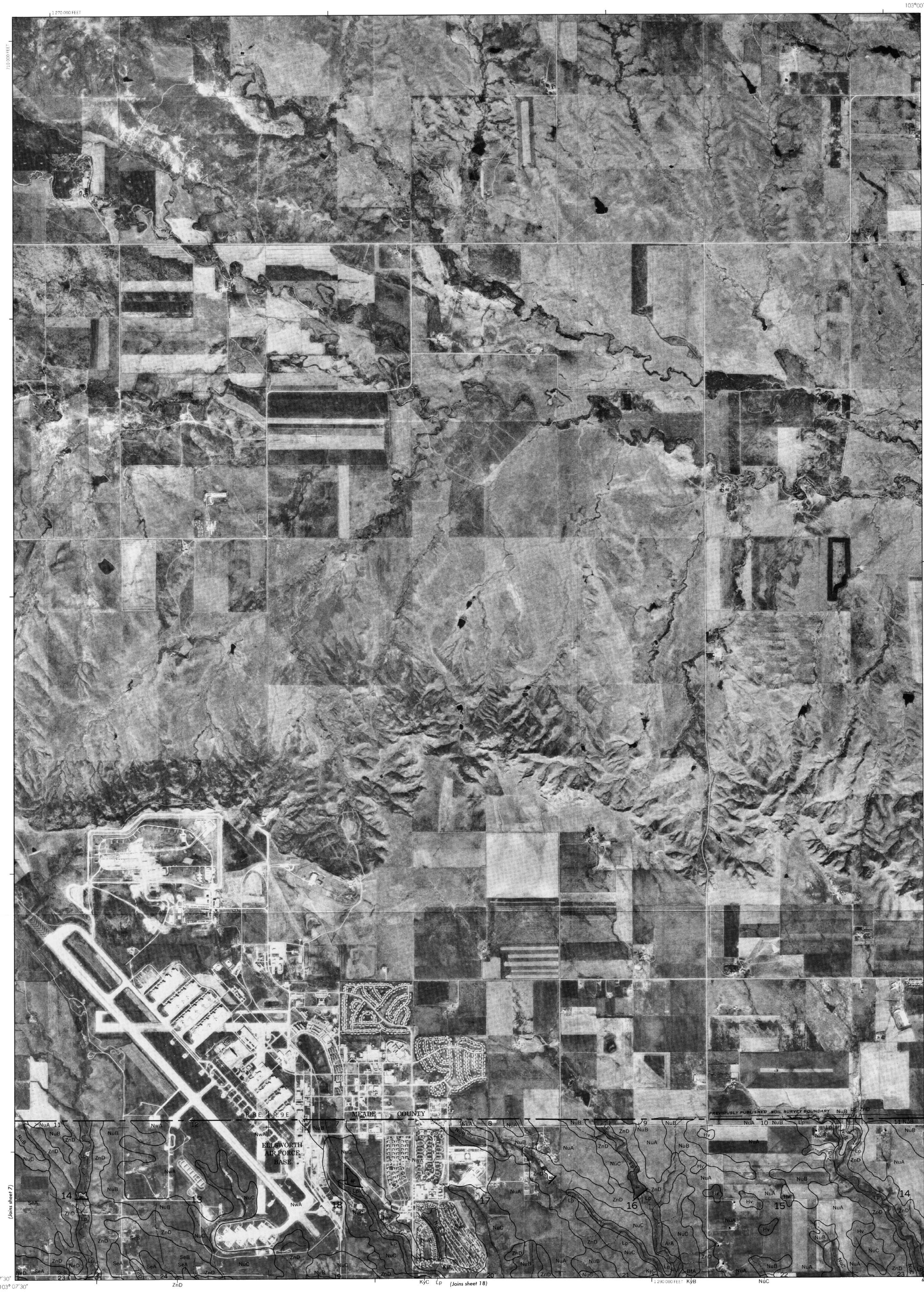

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

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N

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

CUSTER AND PENNINGTON COS., S.D. PRAIRIE PARTS NO. 10

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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N

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000
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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

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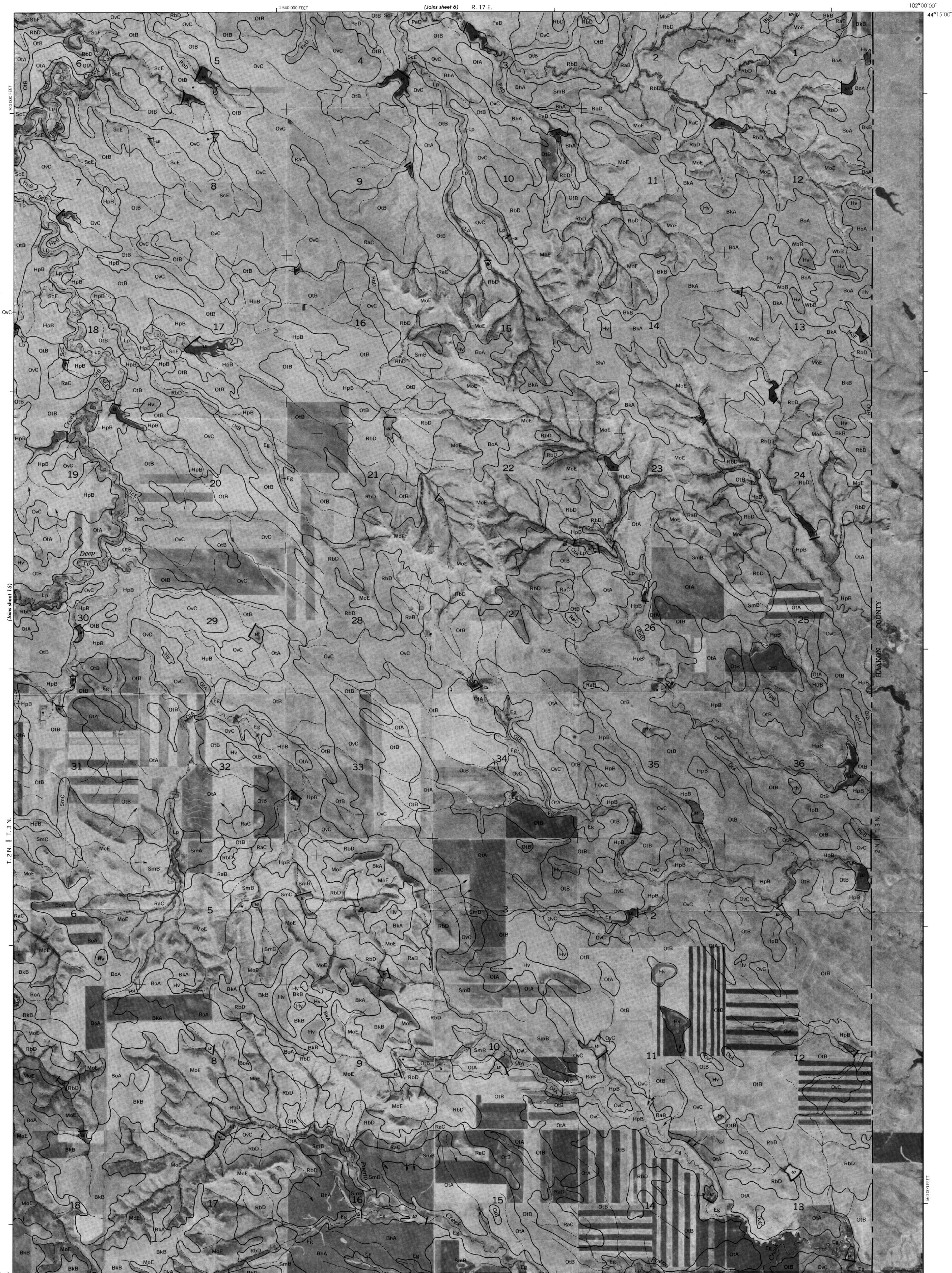

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

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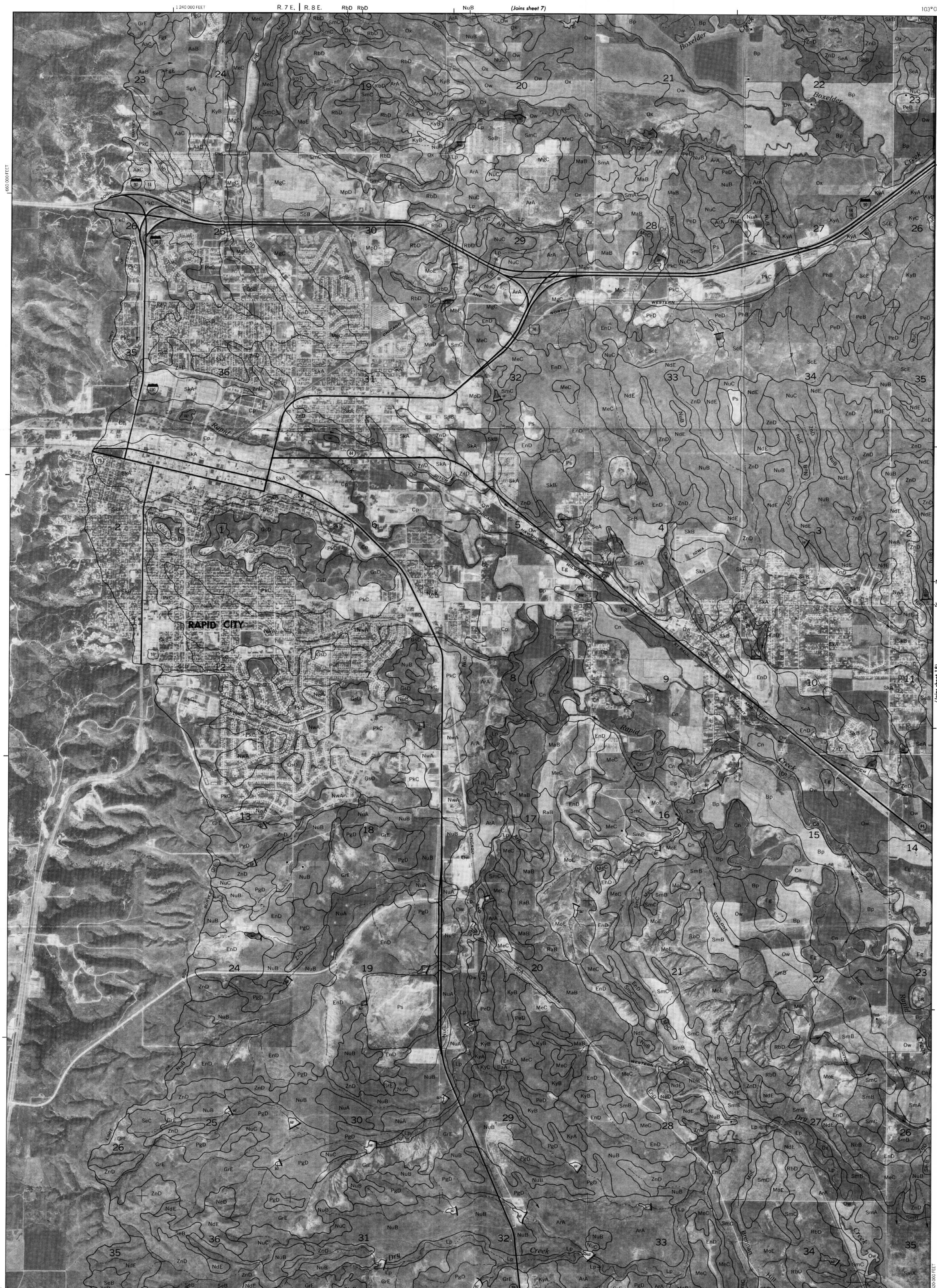

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

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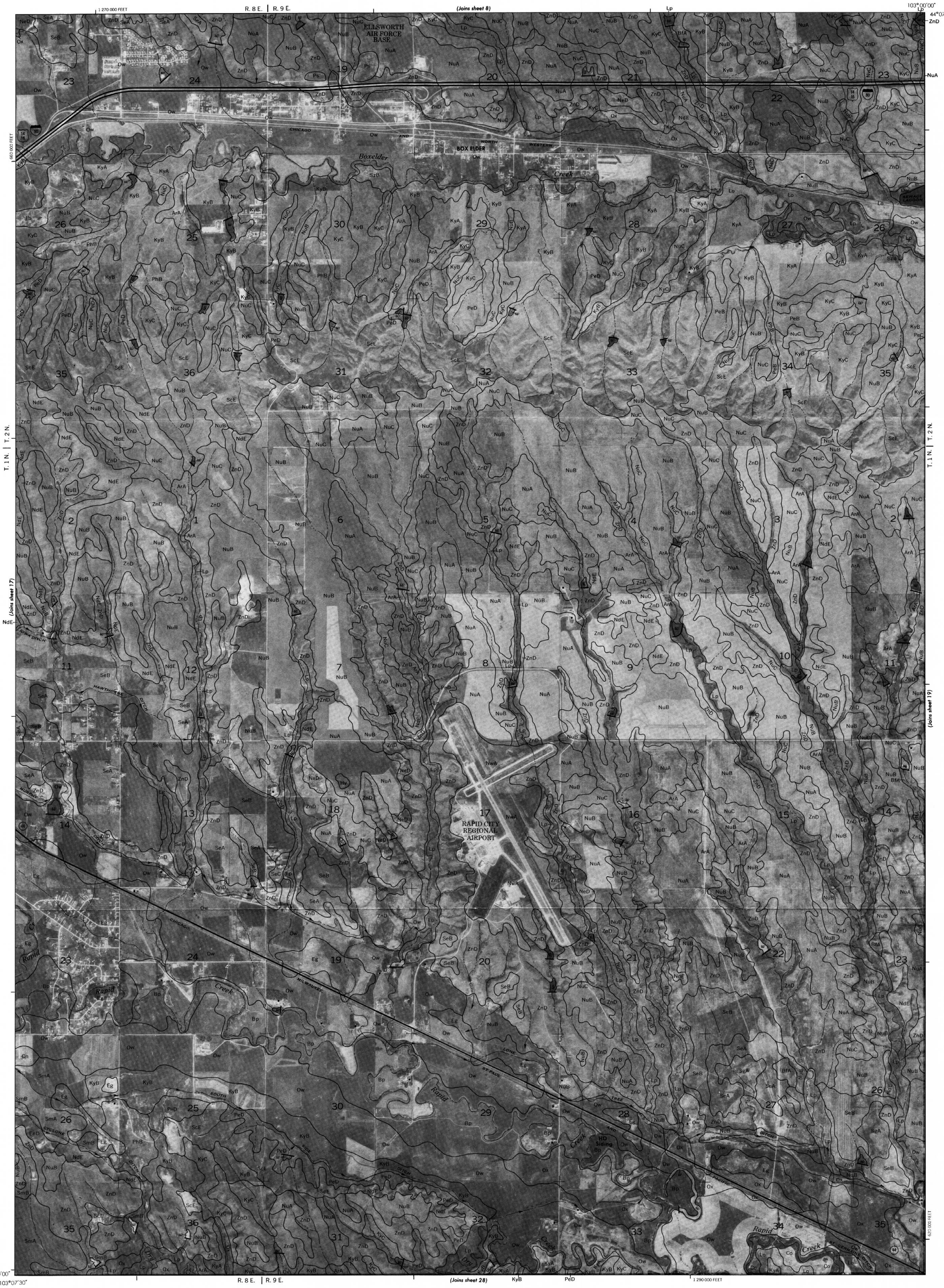

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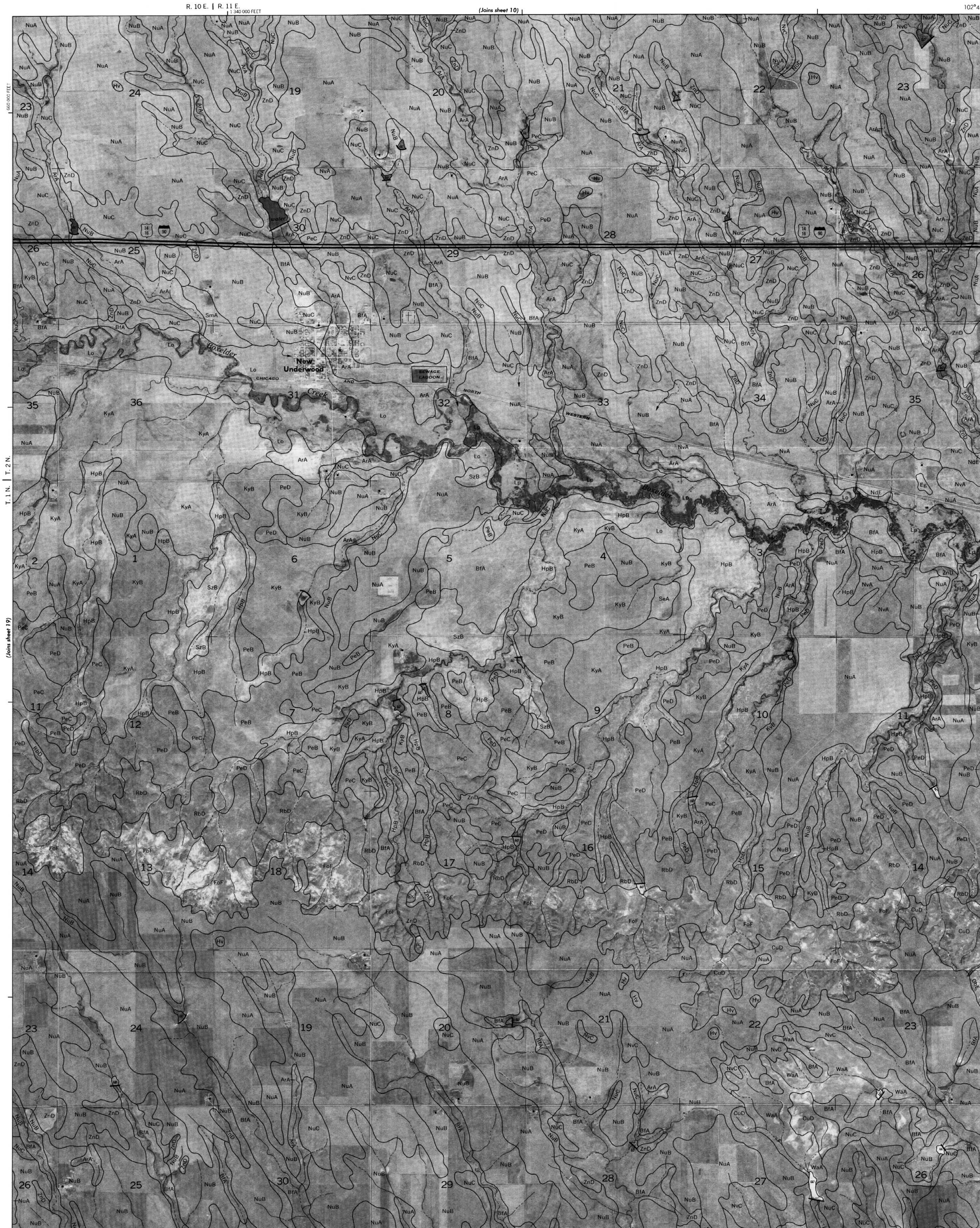

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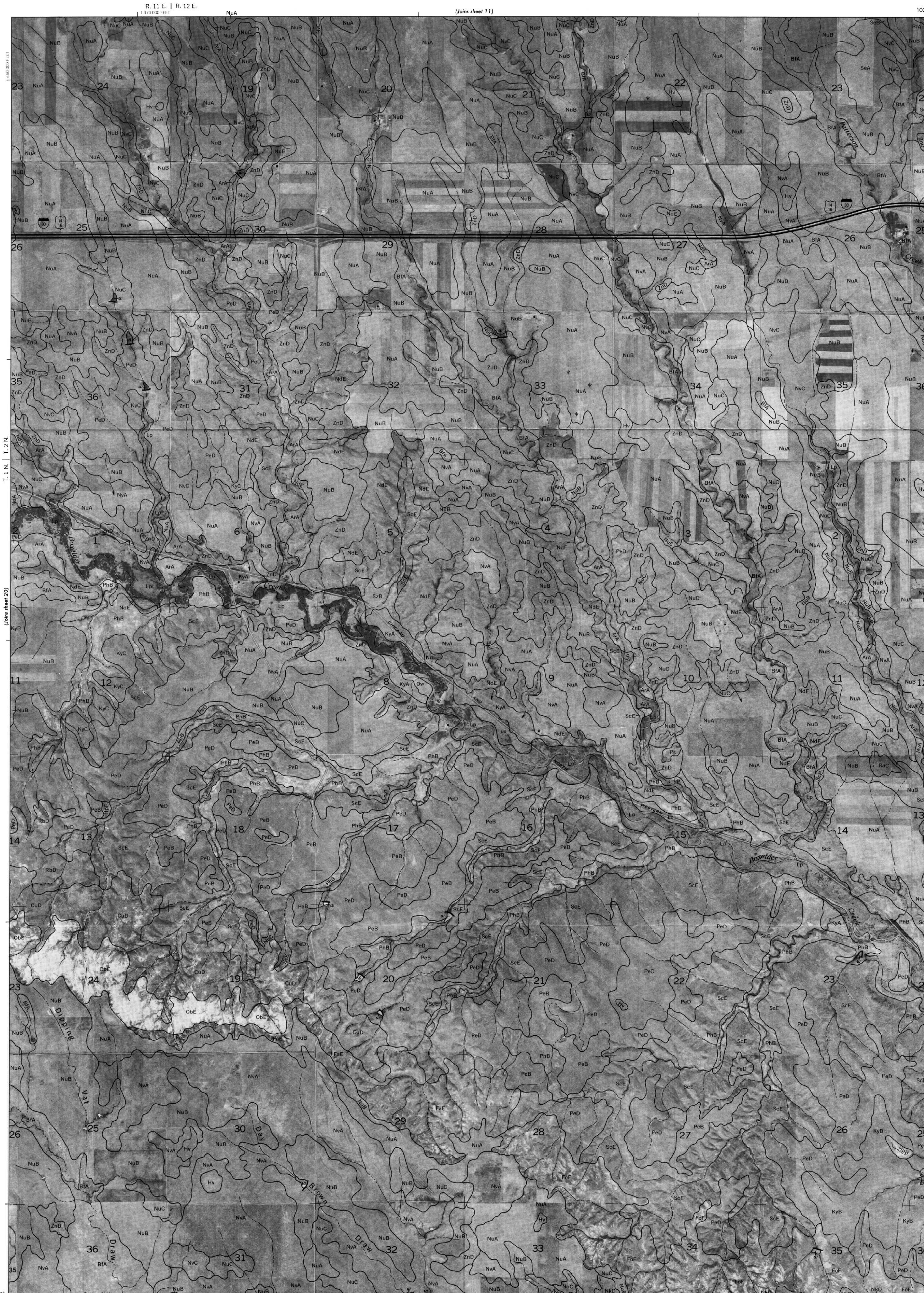

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

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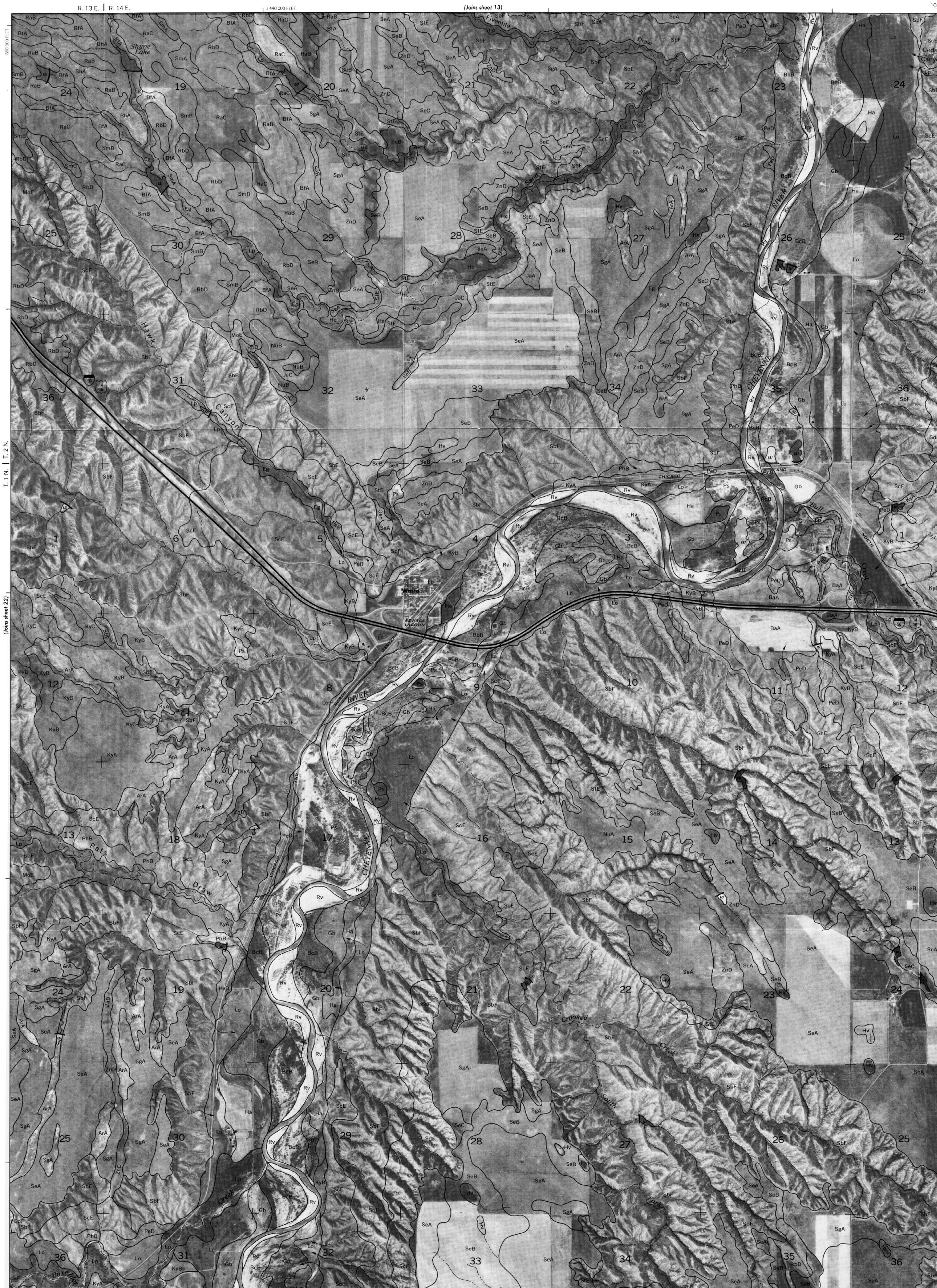

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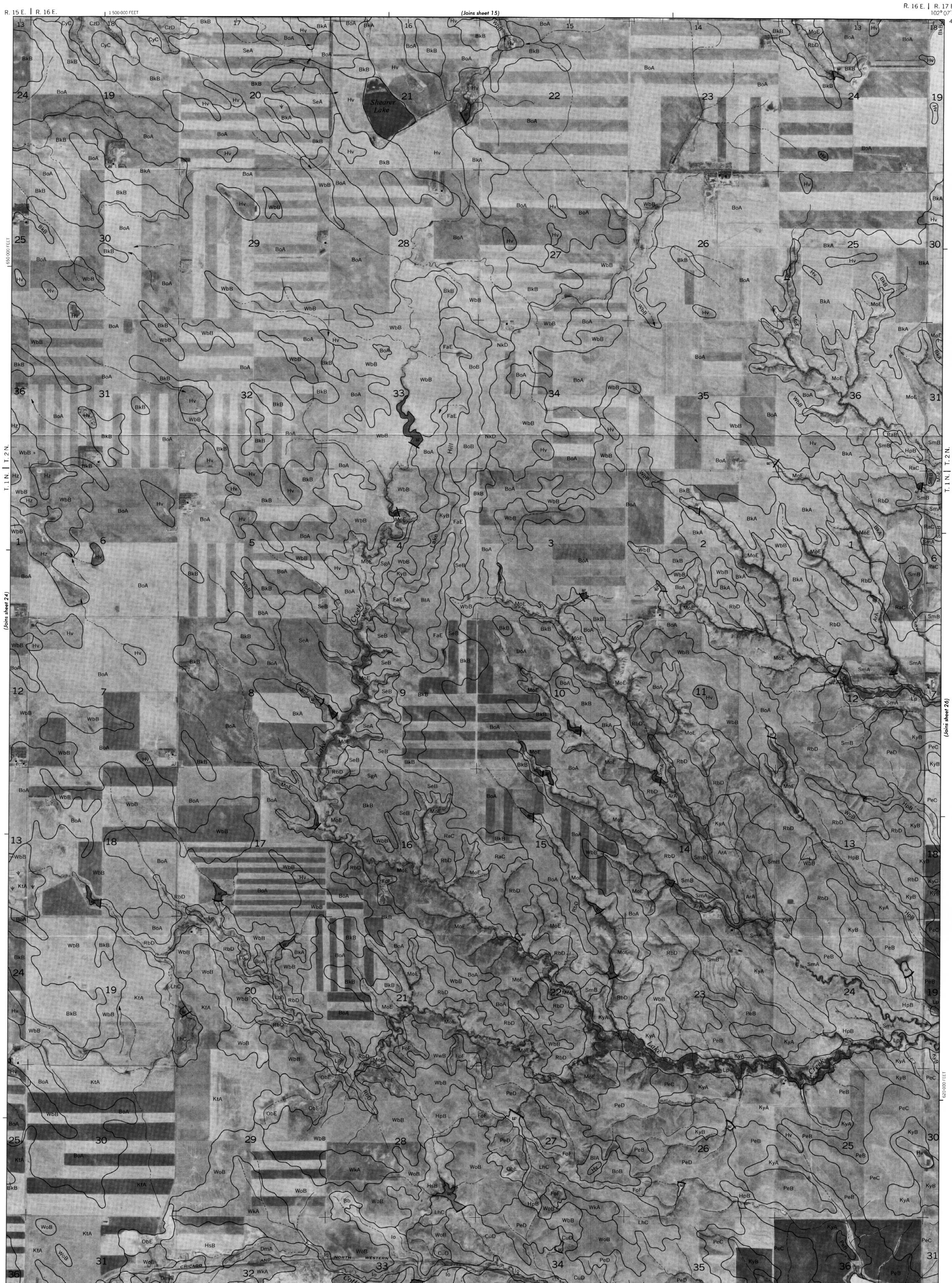

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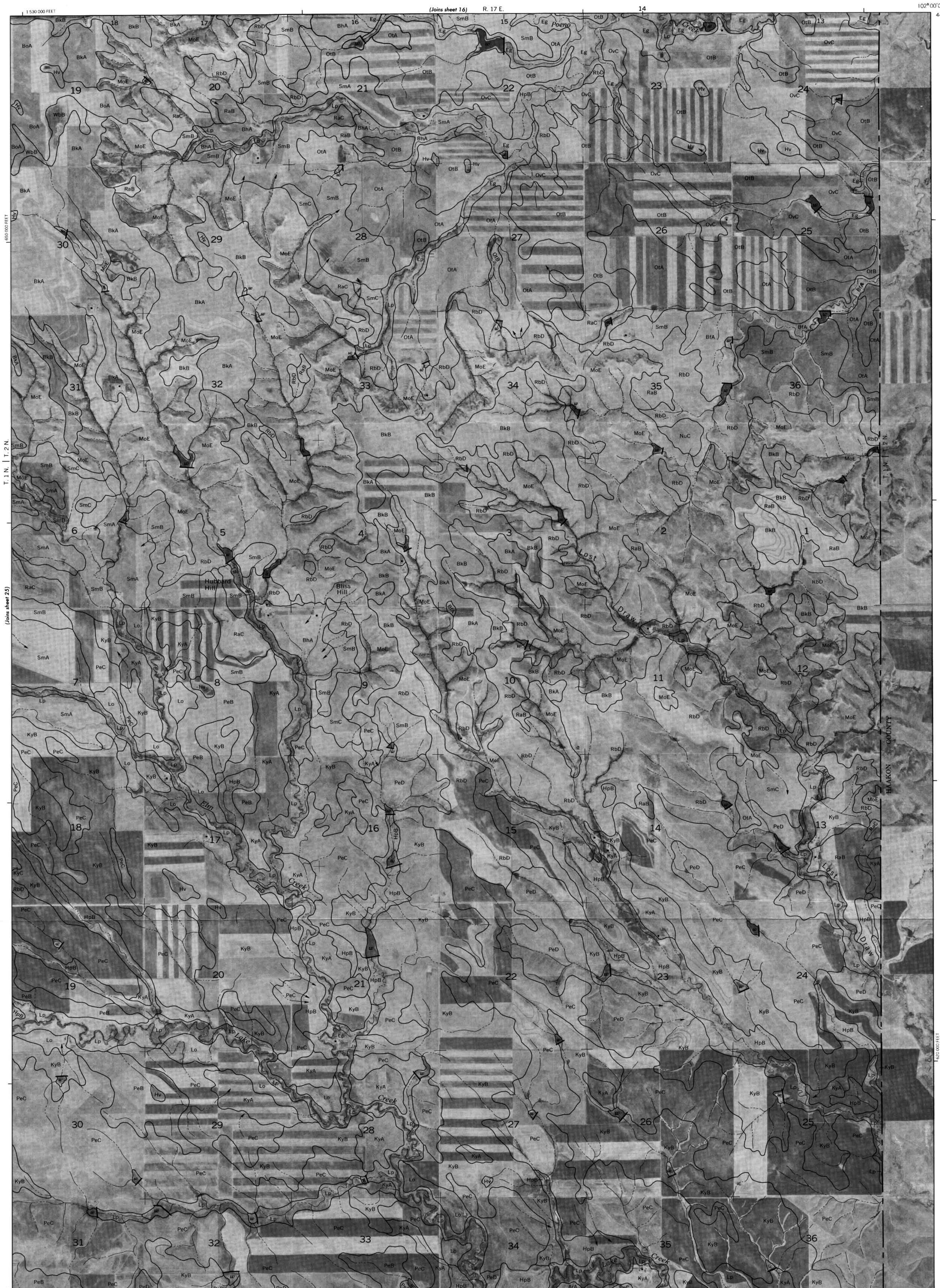
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000



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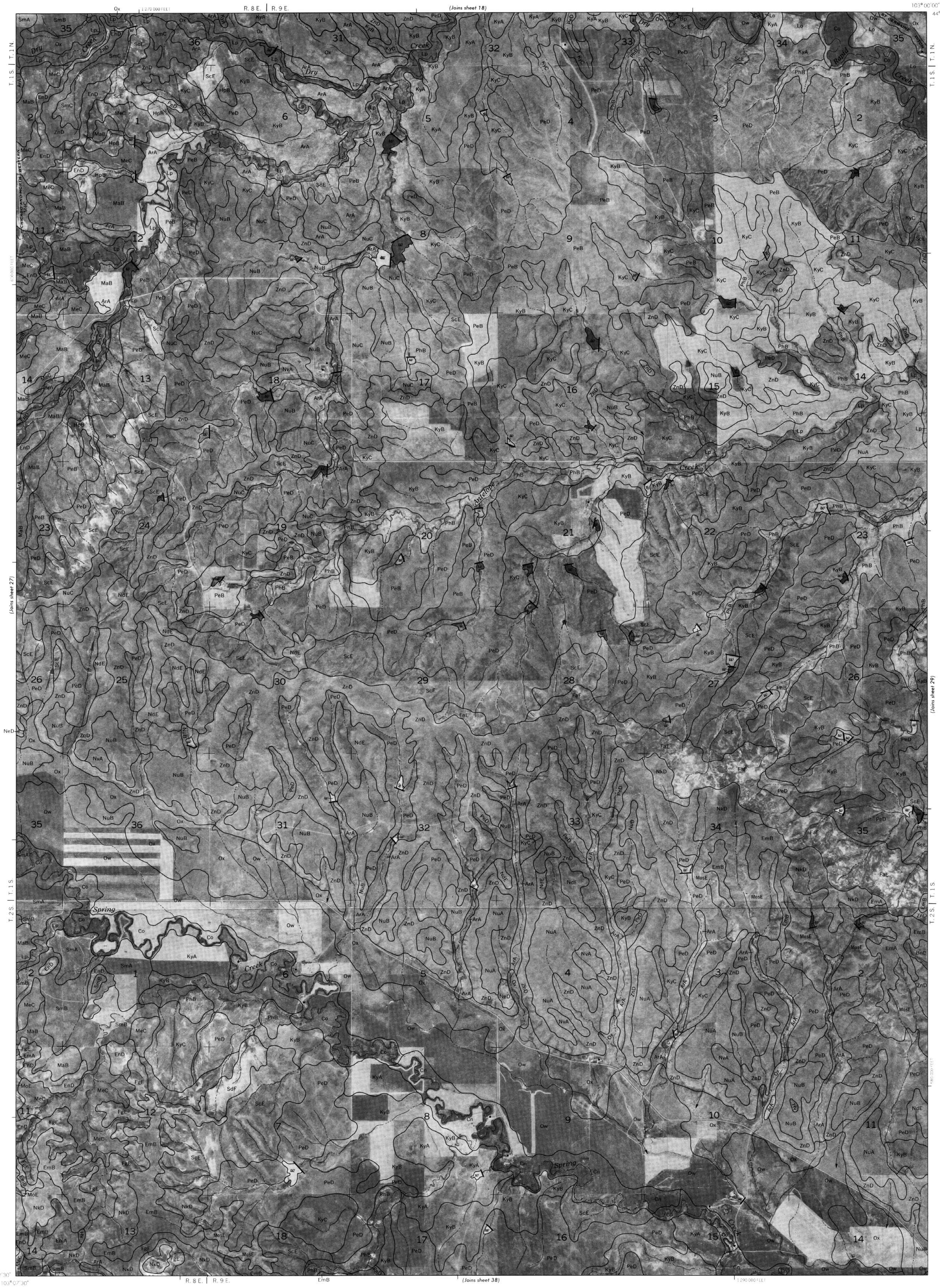
SCALE 1:24 000

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

N



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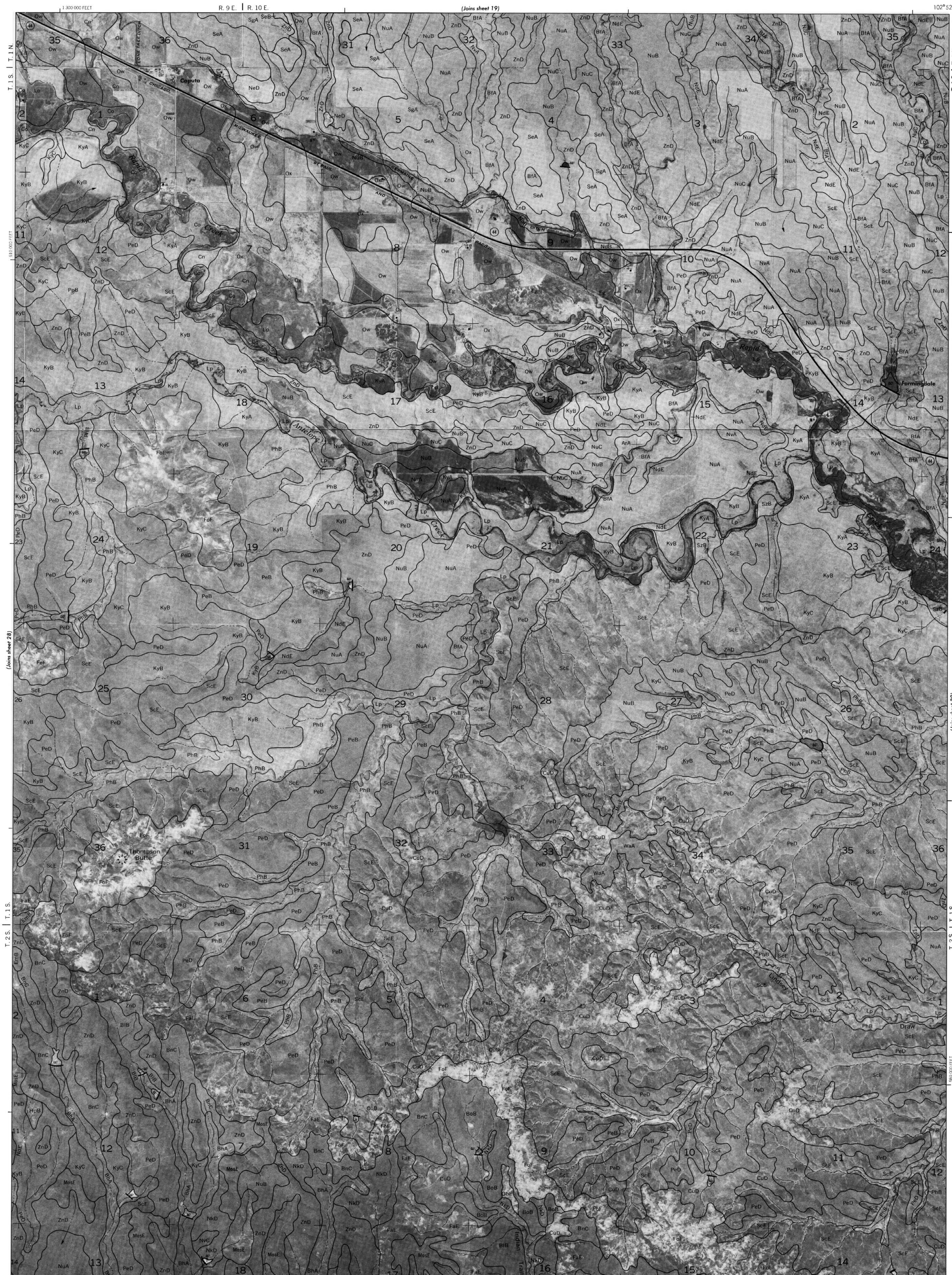
1 MILE, 2 MILES; 1 KILOMETER, 2 KILOMETERS

SCALE 1:24 000

N



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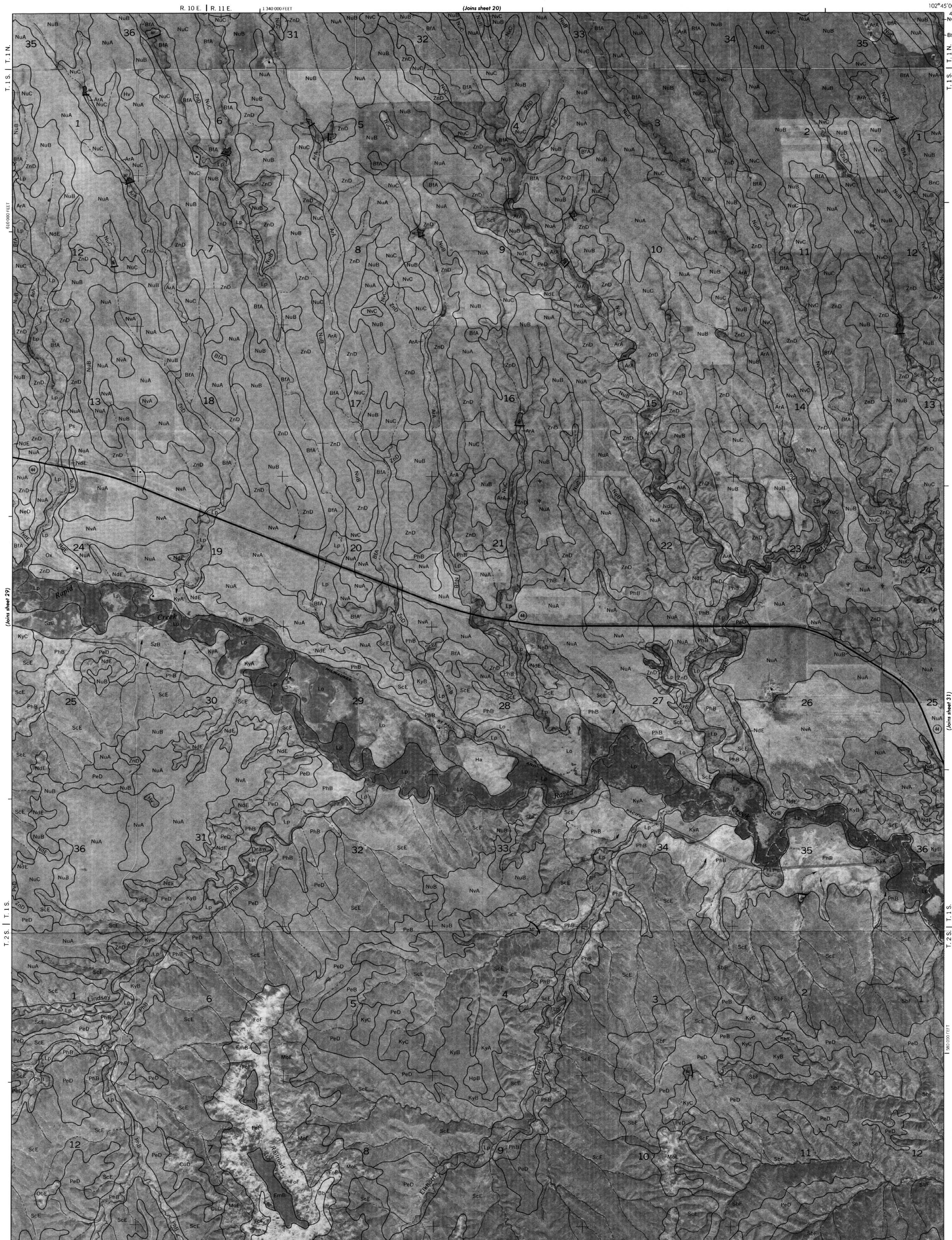
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
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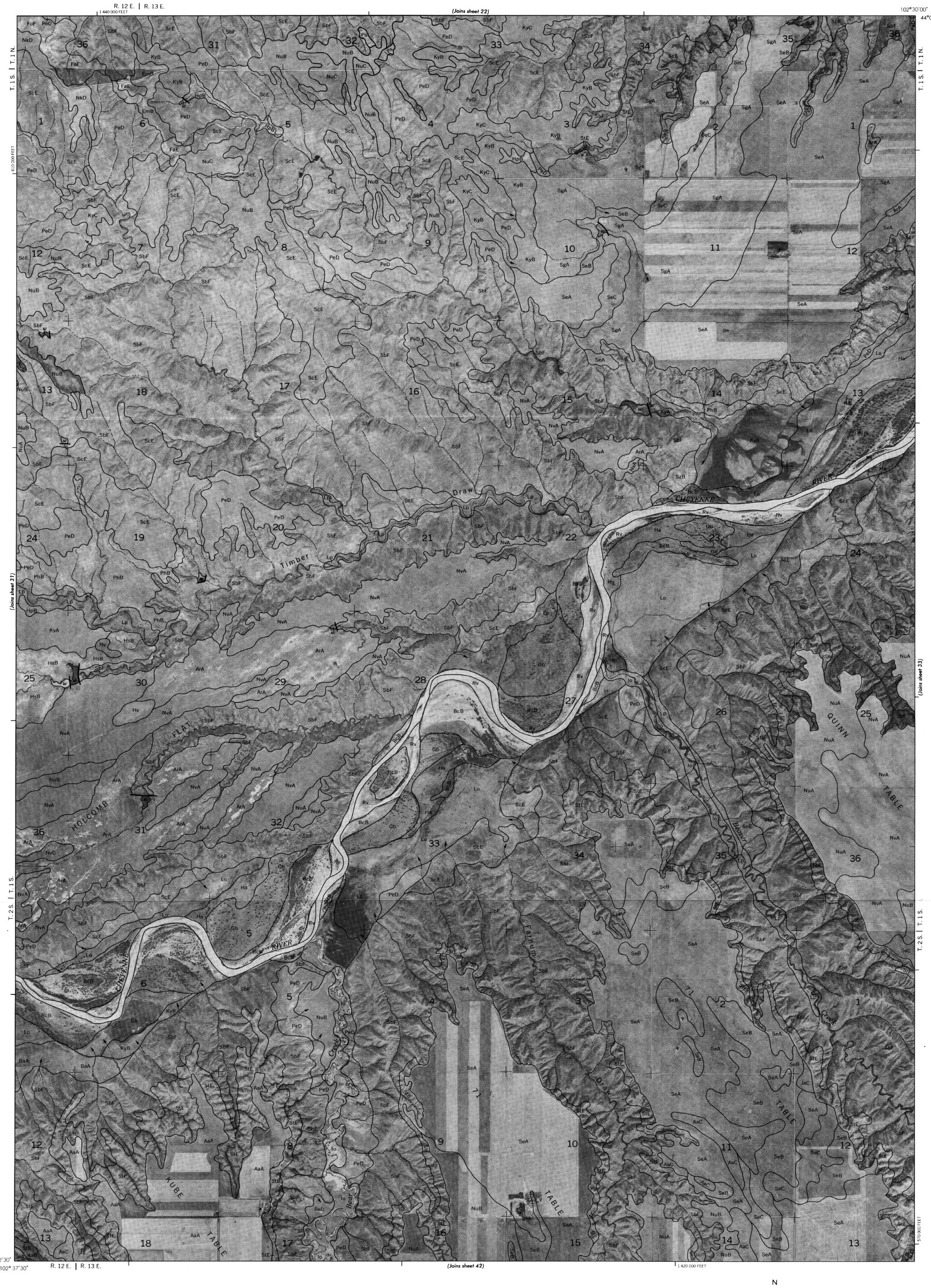
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N



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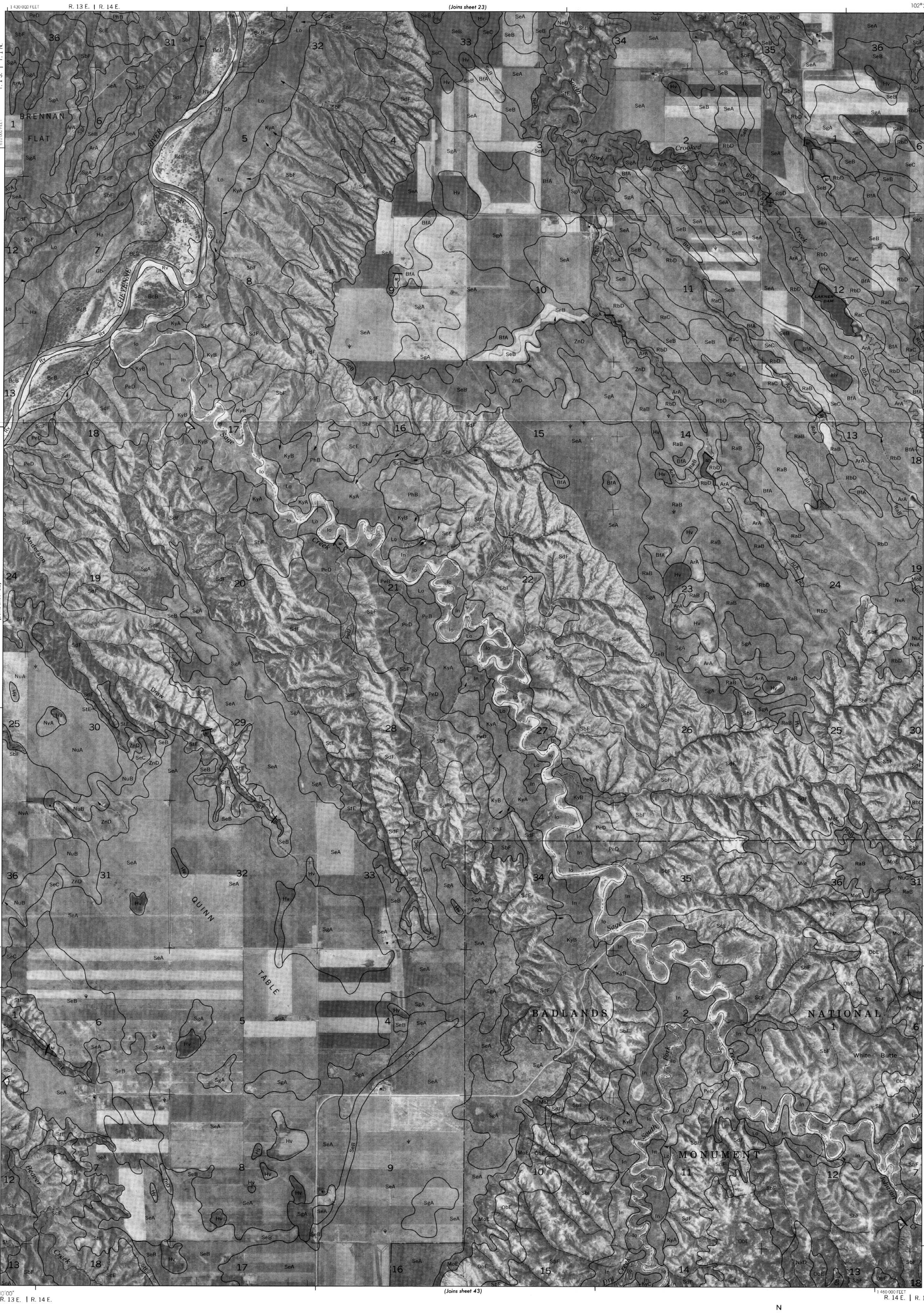

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1 3/4 1/2 1/4 0 1 2 MILES
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1 3/4 1/2 1/4 0 1 2 MILES

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SCALE 1:24 000

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 36
SOIL SURVEY OF CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA, PRAIRIE PARTS

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SCALE 1:24 000
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

N

CUSTER AND PENNINGTON COS., S.D. PRAIRIE PARTS NO. 36

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1 330 000 FEET R. 10 E. | R. 11 E. (Joins sheet 30) 102° 45′00″ 43°52′30″

(Joins sheet 39) T. 3 S. | T. 2 S. (Joins sheet 41) 570 000 FEET 530 000 FEET PENNINGTON COUNTY

43°45′00″ 102°52′30″ R. 10 E. | R. 11 E. (Joins sheet 51) 1 360 000 FEET

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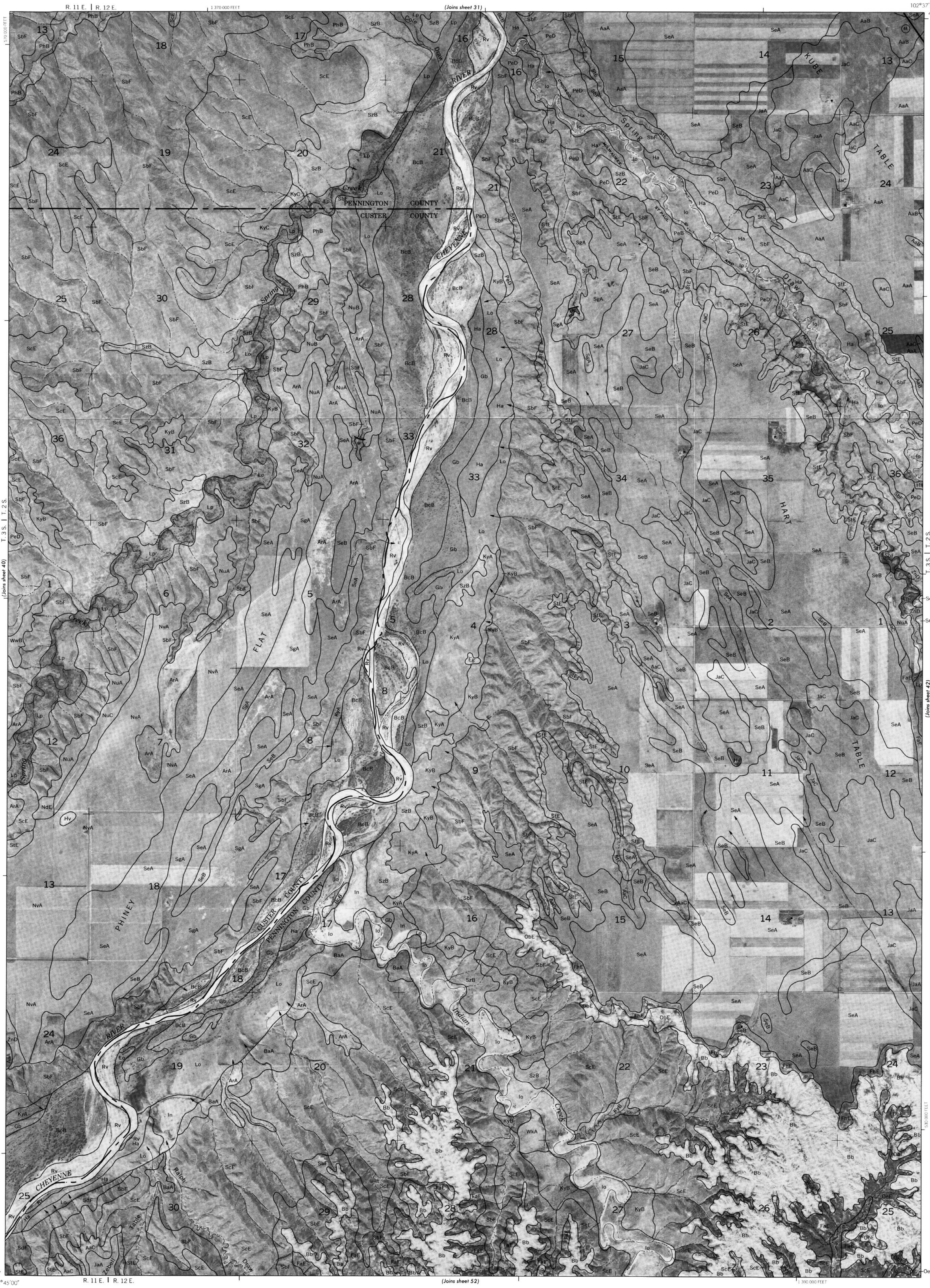

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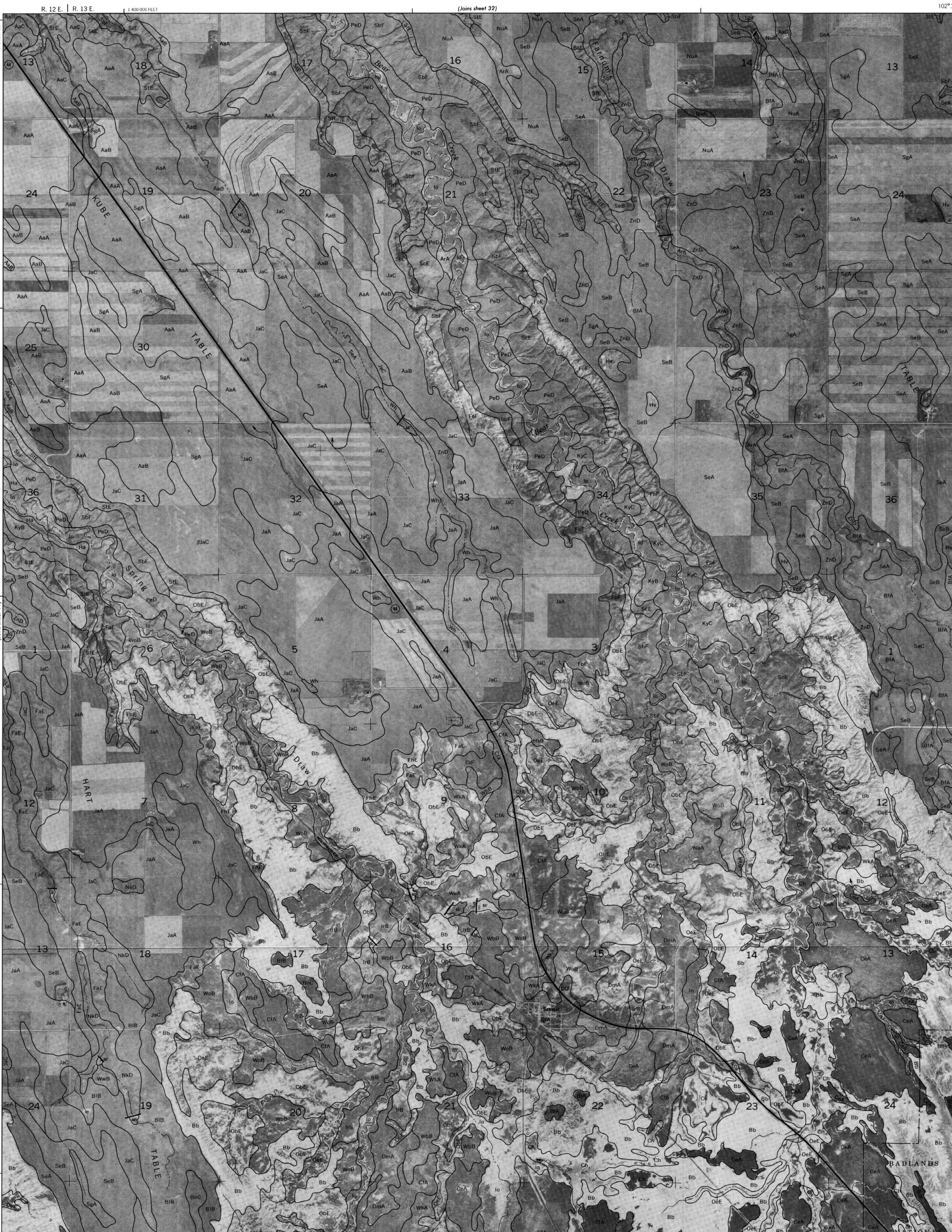

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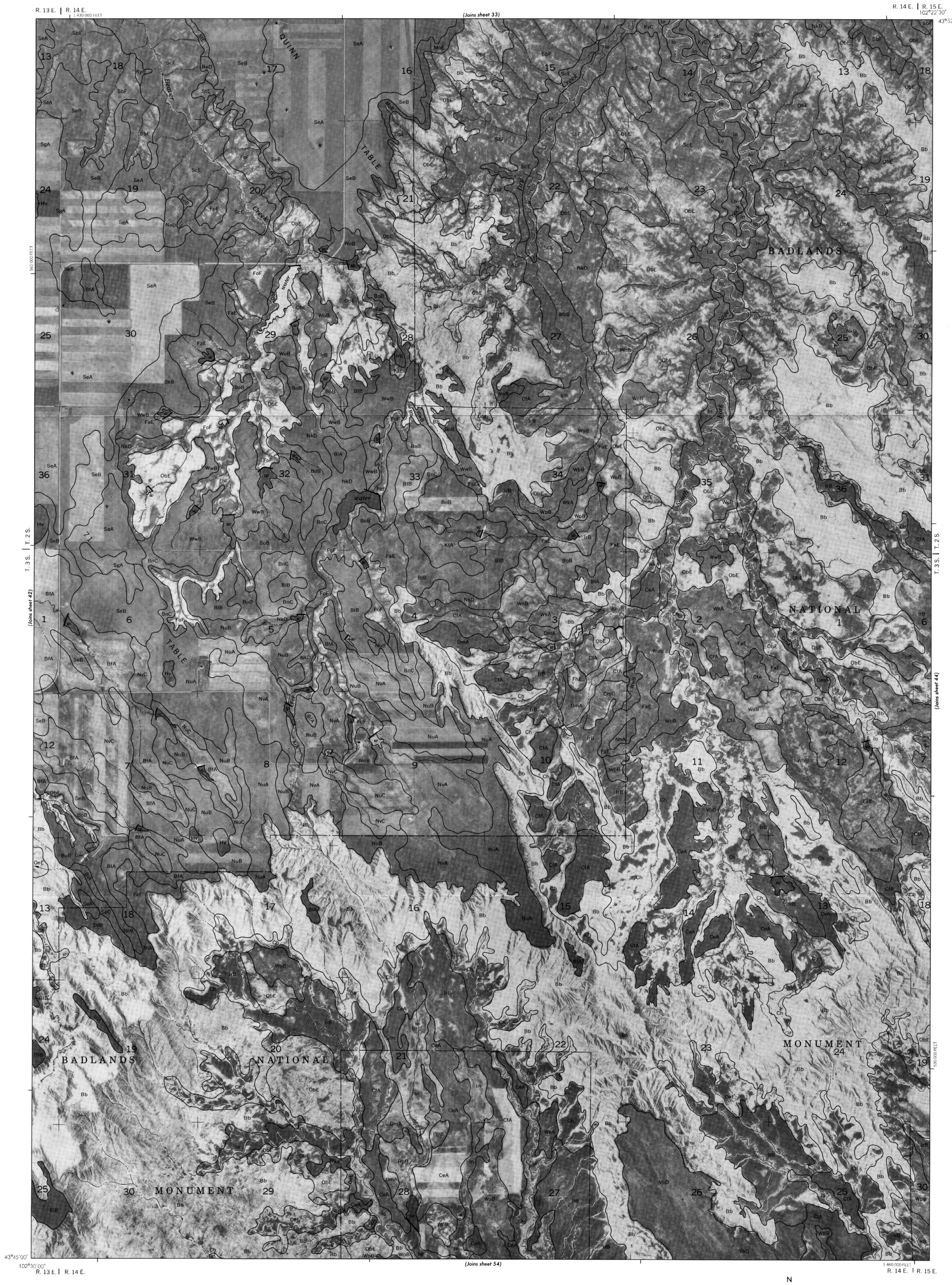

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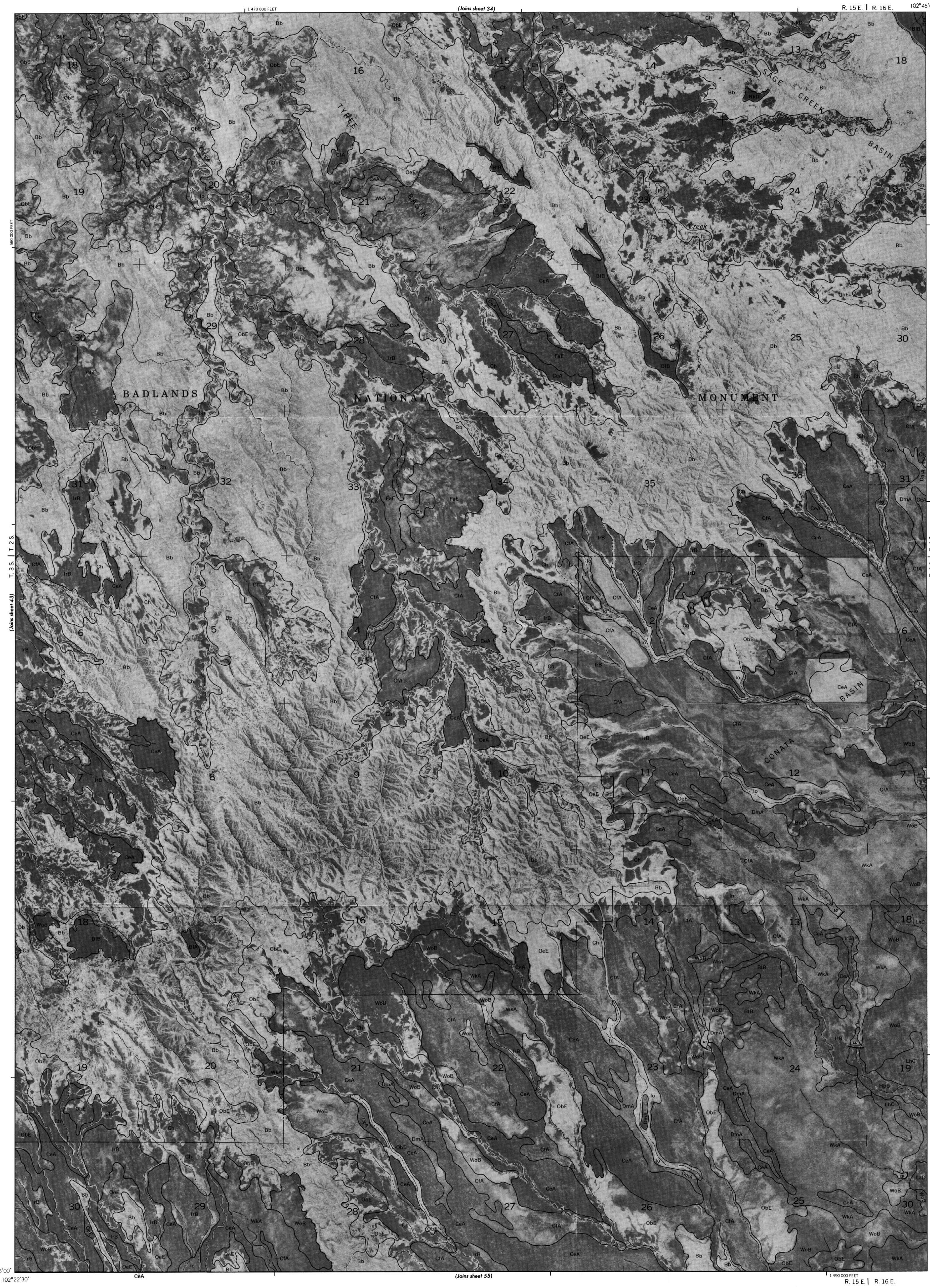

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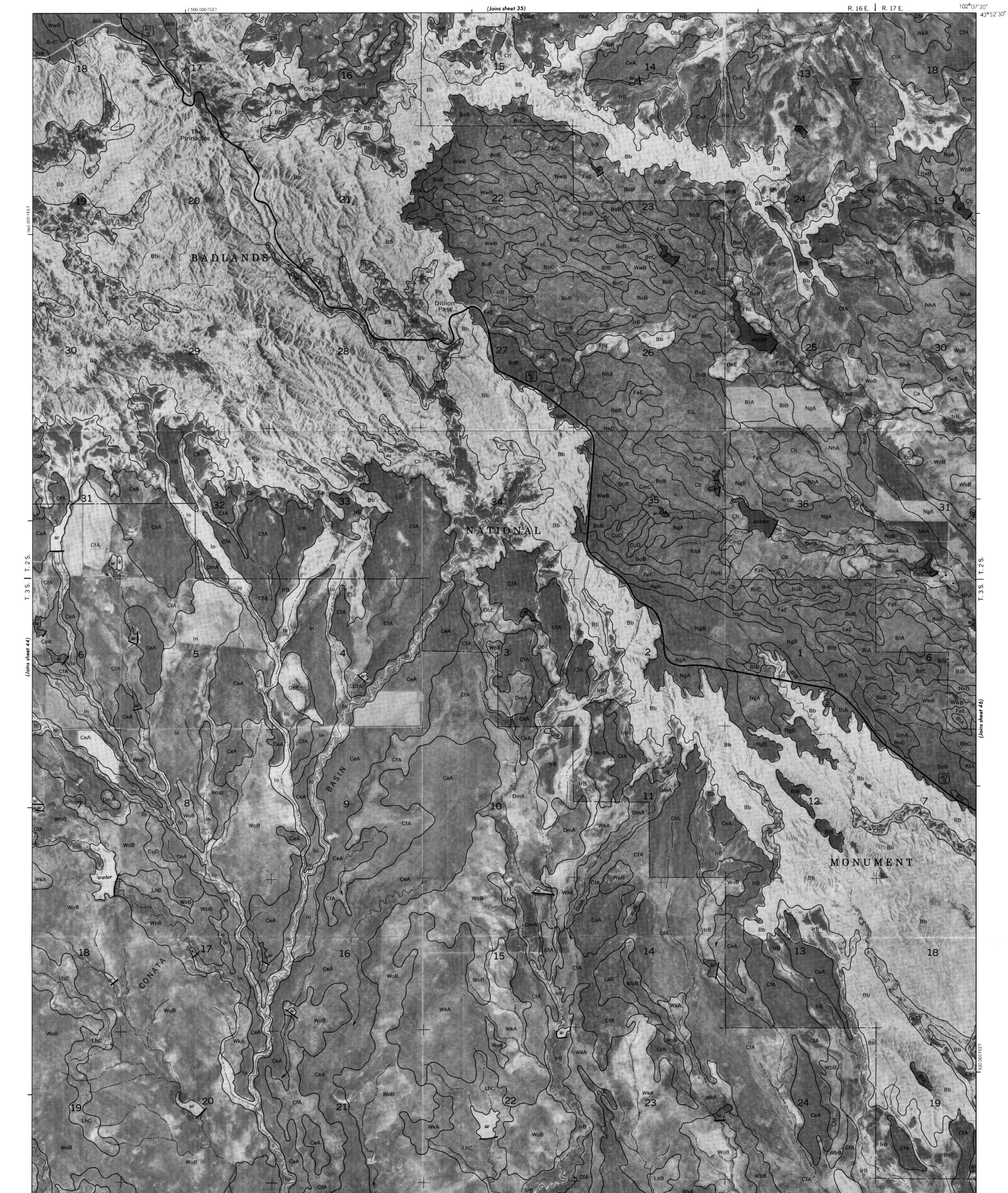

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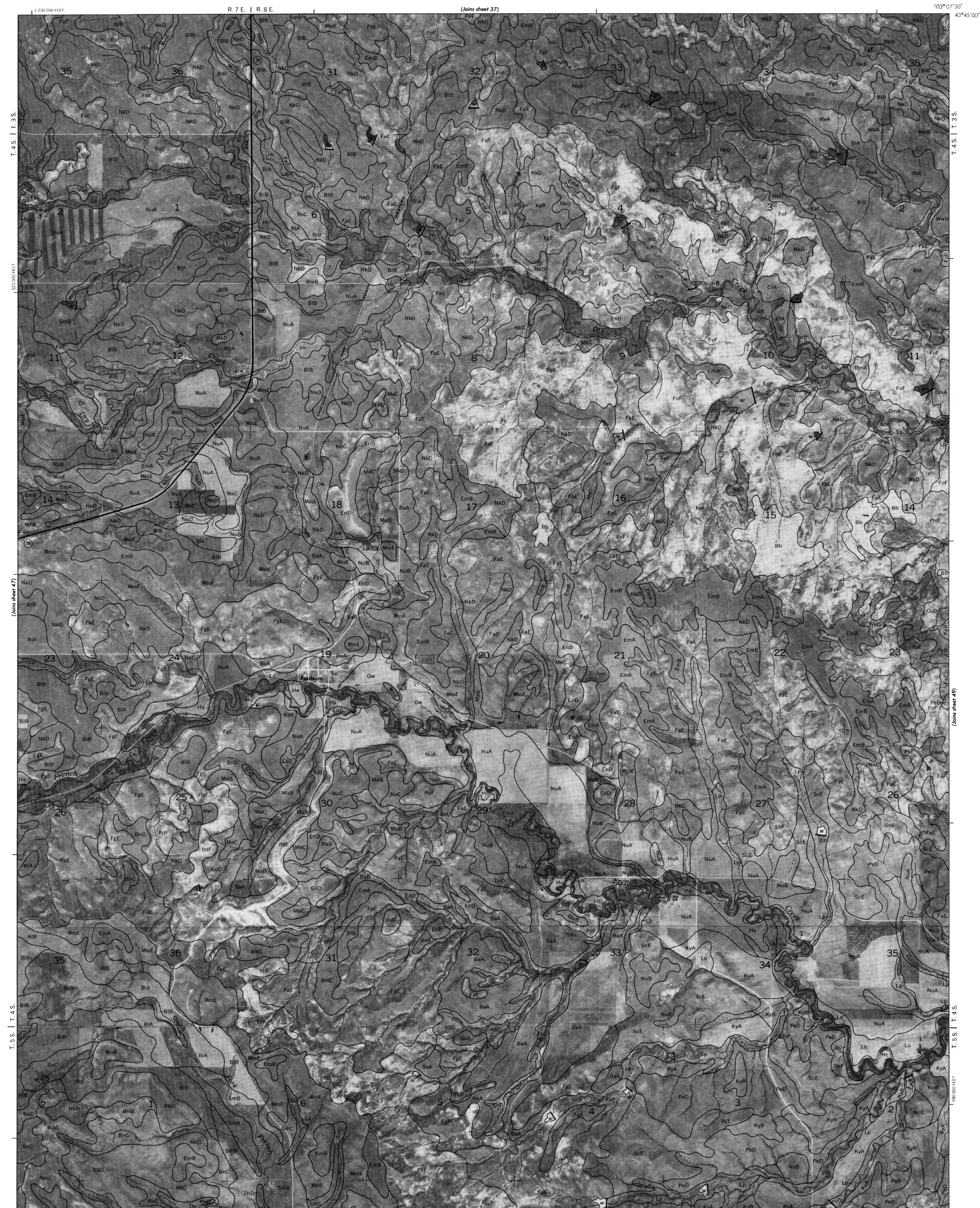

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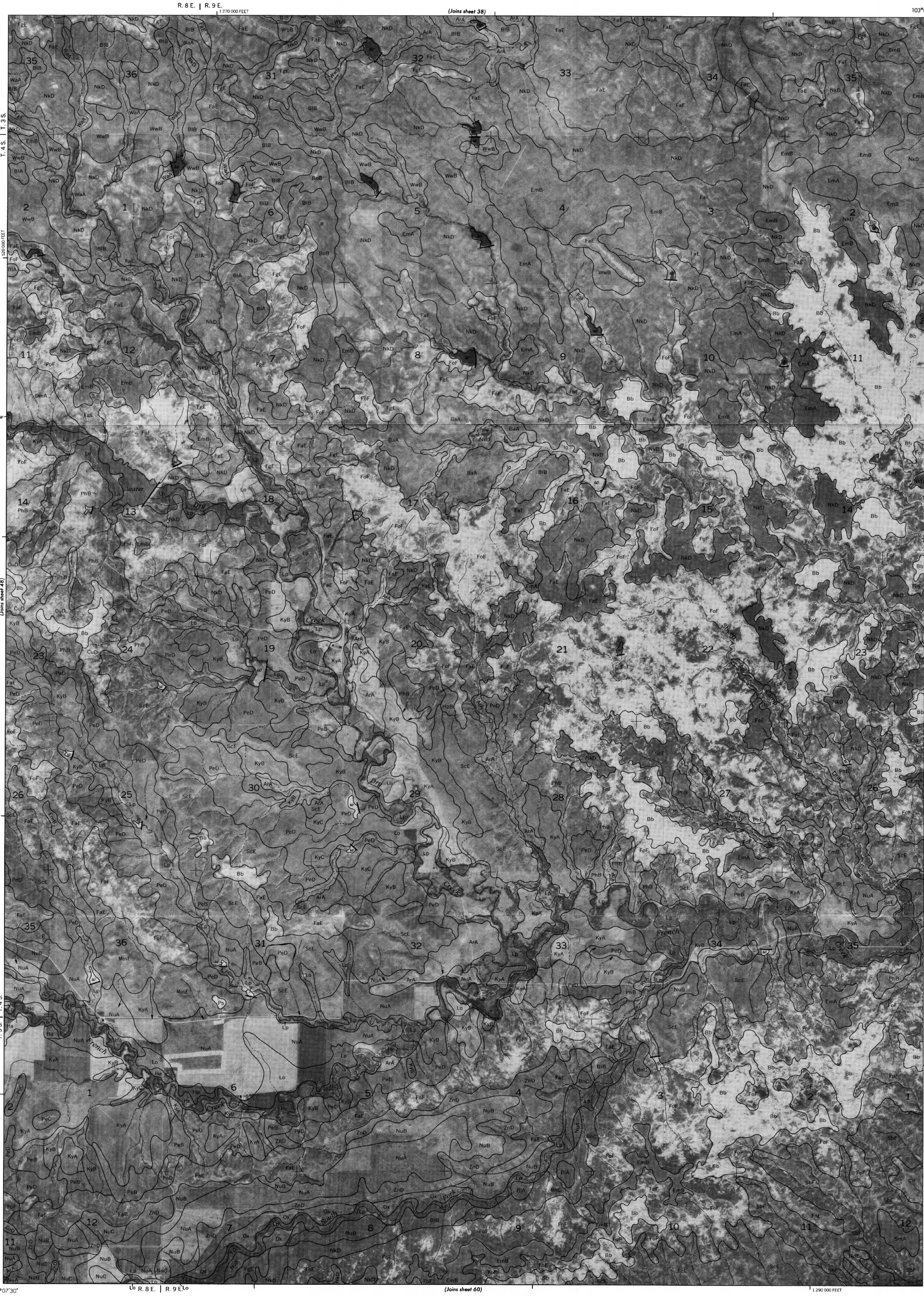

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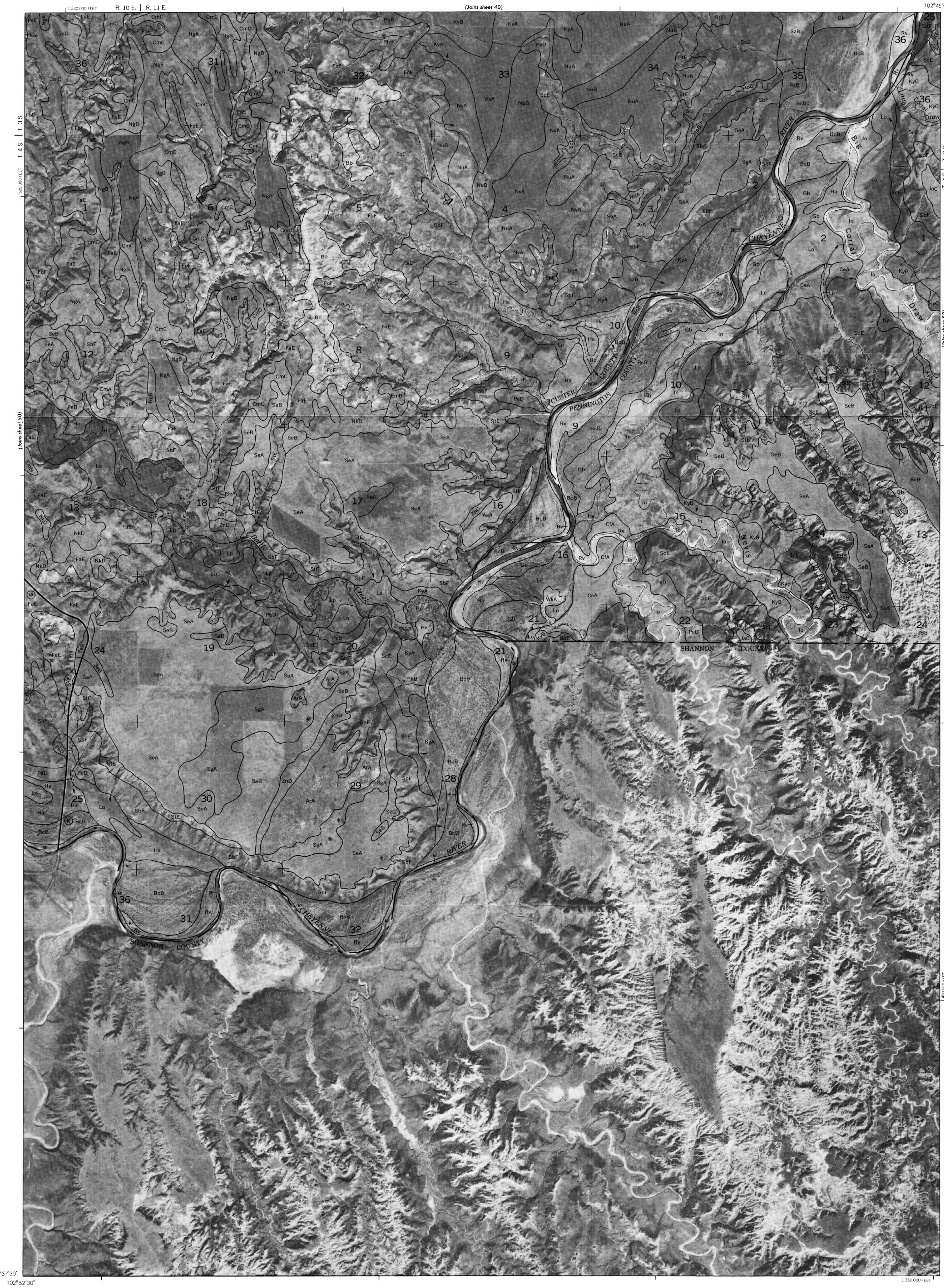

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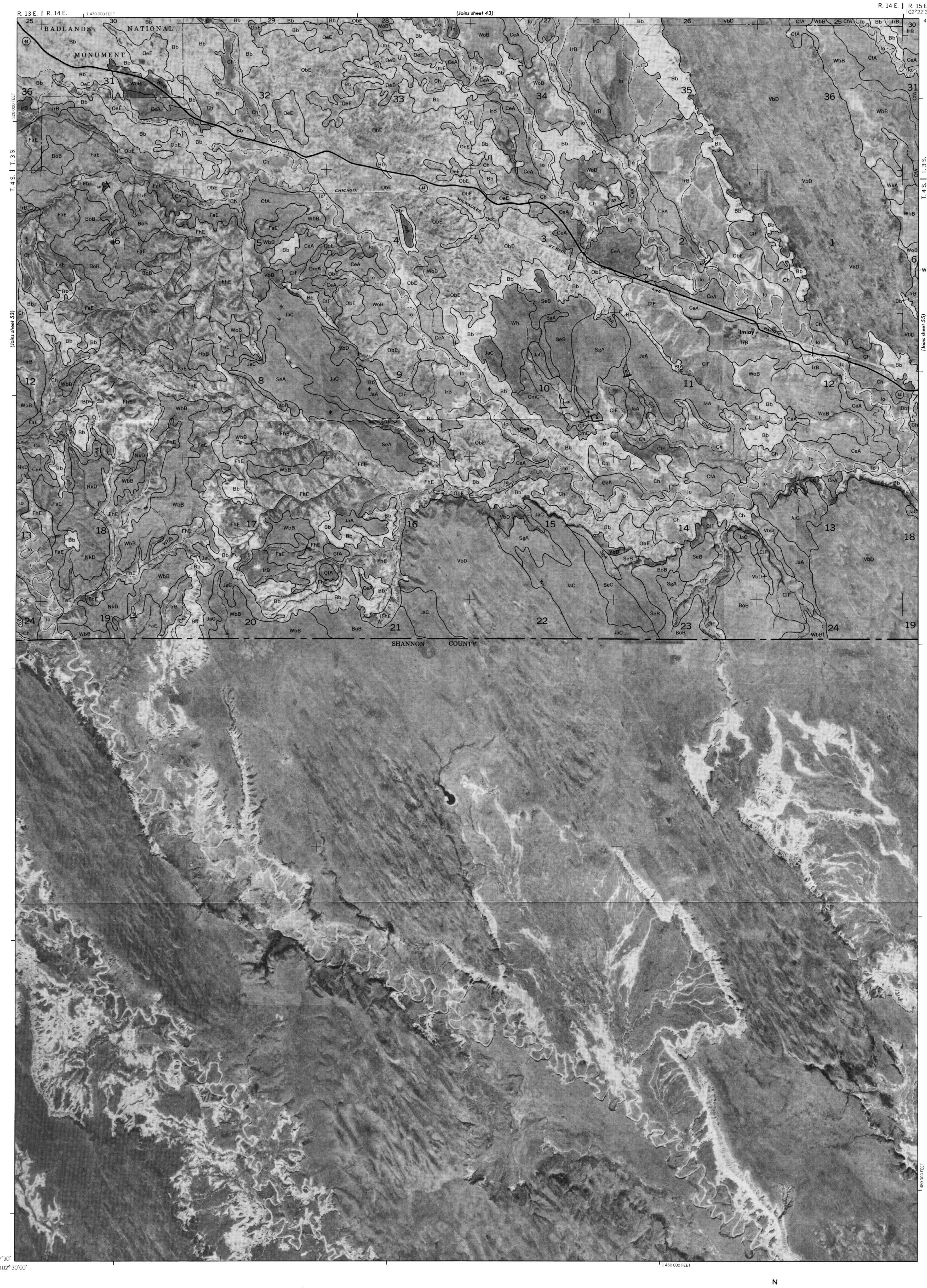

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U. S. DEPARTMENT OF AGRICULTURE
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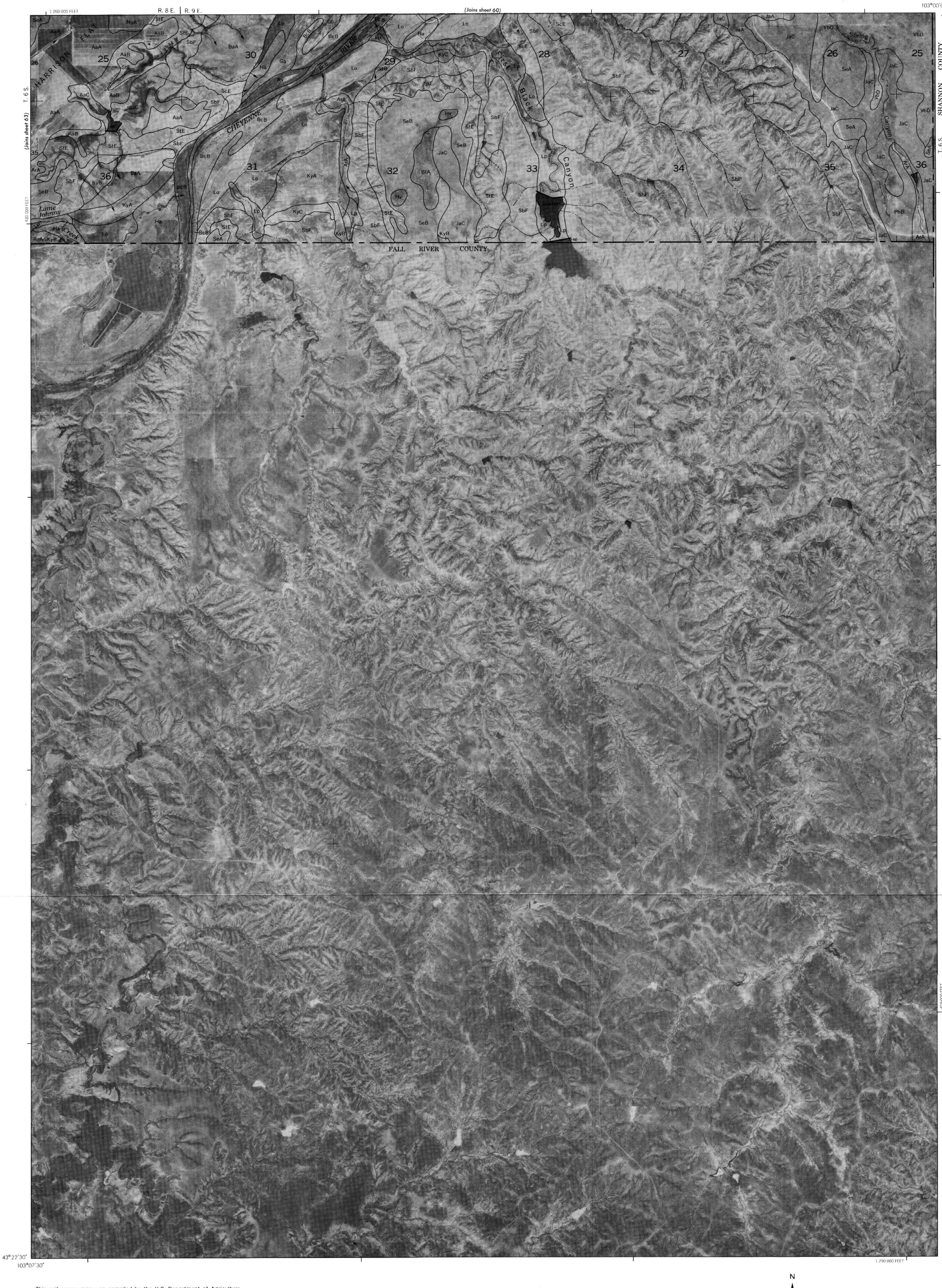

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